AIR ENGINEERING

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JUNE, 1961

AIR QUALITY CONTROL . . . FOR COMFORT, PROCESS AND PROFIT

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- Ventilating Drummed And Bagged Solids Transfer p. 29
- Air Conditioning For Automated Pill Factory p. 30
- Climate-Control Reduces Missile Component Rejects p. 35

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New Methods For Ventilating Electrically Heated Schools p. 26

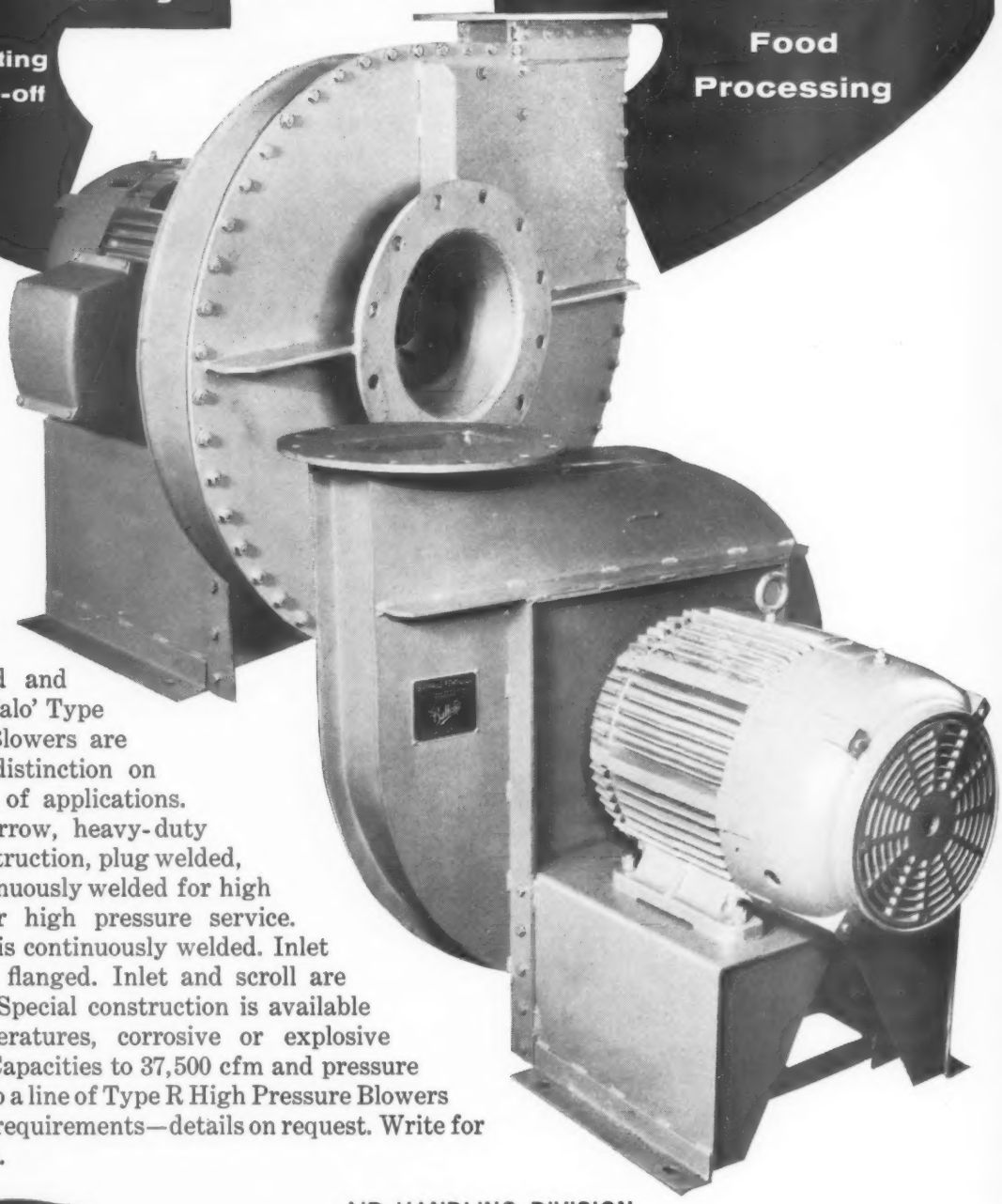
FOR THESE APPLICATIONS

Pneumatic Conveying
Glass Blowing
Air Compression
Furnace Blowing
Testing Blocks
Gas Boosting
Cooling
Drying
Gas Exhausting
Scale Blow-off

'BUFFALO' PRESSURE BLOWERS

FOR THESE INDUSTRIES

Chemical
Steel
Glass
Textile
Food Processing



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Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

[For more information circle #11 on page 51 reply cards]

AIR ENGINEERING

VOL. 3, NO. 6

JUNE, 1961

AIR QUALITY CONTROL . . . FOR COMFORT, PROCESS, PROFIT

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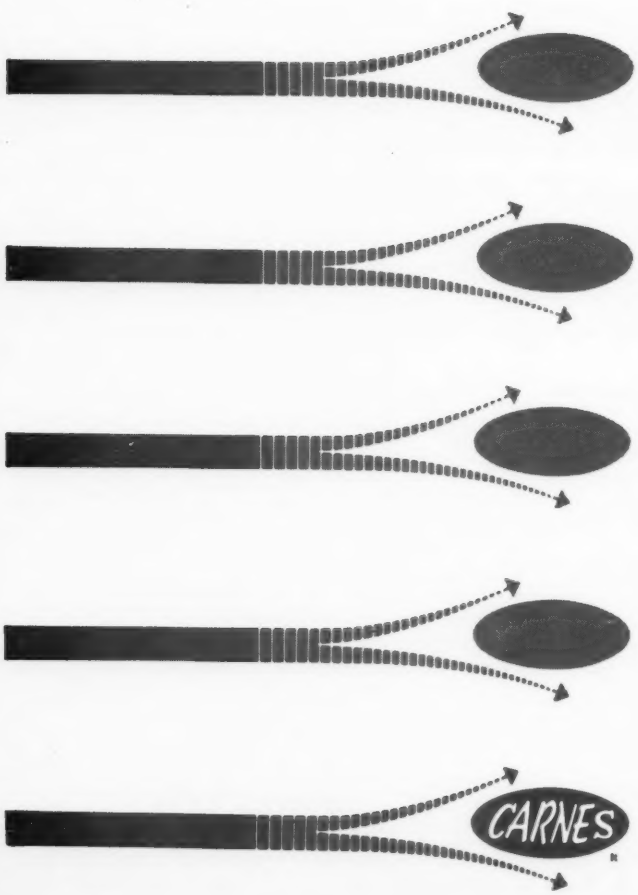
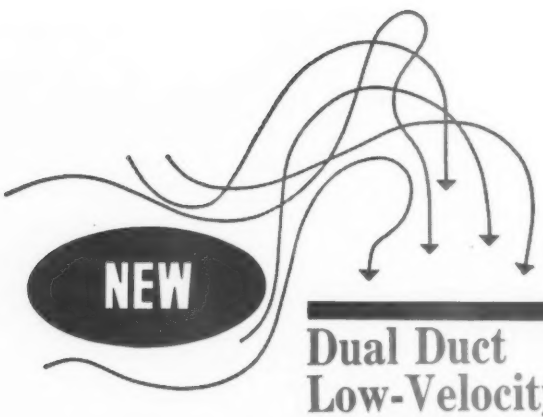
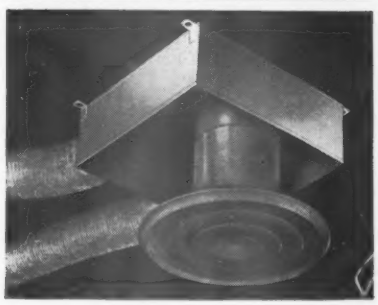
LEADERS GO TO CARNES FOR THE NEWEST IN AIR DISTRIBUTION





Dual Duct Low-Velocity ATC Units



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Carnes Low-Velocity Acoustic Terminal Control Units — ATC — provide "pinpoint" temperature control for specific zones through the flexibility of dual duct air distribution without the need for sealed ducts, high pressure fans and high fan horsepower. Carnes Low-Velocity ATC Units proportion the hot and cold air in response to individual room thermostats . . . blend the hot and cold air for discharge to individual space areas . . . attenuate self-generated noise plus duct-carried noise . . . provide manual volume adjustment.

For complete information, write for Carnes Low-Velocity ATC Catalog 1361.

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EDITORIAL:

A New Association Is Formed... For Contamination Control

ASTRONAUT SHEPARD'S FLIGHT to fame was made possible, as he himself said, by many things and many people.

Of these, an important factor was our own industry . . . the engineering of air.

As we all know now, the highly complex controls which permitted Mr. Shepard to manipulate his capsule in the desired orbital and re-entry attitude worked to perfection.

To endow its micro-miniaturized components with the utmost in reliability, the capsule and all of its parts had to be assembled in a controlled climate almost entirely free of air contaminants.

Because not only the Mercury capsule and its parts, however, but also many other components of rockets and missiles and civilian products as well are sensitive to fine particles, the topic of contamination is today an urgent one with many thousands of engineers.

Contaminated air is a problem wherever products, military or civilian, are ultra small, super precise, or must be highly pure chemically or biologically.

The problem of contamination control is further complicated by a lack of standards, of how much dust is permissible for what product, of even how to measure dust so all will agree on the results. Design of engineered air facilities for contamination control varies from company to company.

For these reasons engineers have been asking for a professional, technical association devoted exclusively to methods and standards of contamination control. In a field so complex as contamination control, which makes use of so many sciences like biology, microscopy, air quality control, no existing association is comprehensive enough to serve all of these endeavors.

We are happy to report that such a new associa-

(Please turn to following page)

Editorial (Cont.)

(Continued from preceding page)

tion has been formed. The new association, known as the AMERICAN ASSOCIATION FOR CONTAMINATION CONTROL, will serve engineers in industry who are concerned with the control of contaminants.

For example, one of the first activities of the new association will be to meet with the people most knowledgeable about contamination control and to set up a program for standardizing such things as ways and means of taking dust counts . . . degrees of contamination that should be maintained for dirt-sensitive products like liquid oxygen valves, radar tubes, semi-conductors, and thousands of other products civilian and military.

Then, a symposium on contamination control will be set up for sometime during the Spring of 1962, during which experts in every phase of contamination control will present talks on their specialty. Engineers participating will have opportunities to swap problems and solutions, attend question and answer sessions, view contamination control products displayed by hundreds of suppliers.

From this symposium will flow enough technical data to set up the first textbook on contamination control, and to set up the channels for further refining the art of this challenging new science of the space age.

We urge all of our readers who are concerned with contamination control to join this new association. We have arranged to make application blanks available to our readers and we'd be happy to send you one.

Just circle number 200 on the reply card on page 51. You'll get in on the ground floor of an organization that can be a big help to your own operations. ▲▲

Eugene A. Sloane

Editor

Meetings, Expositions

54th Air Pollution Control Assoc. Exposition, *Hotel Commodore, New York City, June 11-15, 1961.*

Electrical Precipitation Seminar, *The Pennsylvania State University, University Park, Pennsylvania, June 12-17, 1961.*

3rd Biennial International Gas Chromatography Symposium, *Kellogg Center, Michigan State U., East Lansing, Mich., June 13-16, 1961.*

Air Pollution Seminar, *Syracuse University, Syracuse, N. Y., June 19-30, 1961.*

68th Annual ASHRAE Meeting, *Denver Hilton Hotel, Denver, Colo., June 26-28.*

4th International Conference on Bio-Medical Electronics; 14th Conference on Electronic Techniques in Medicine & Biology, *Waldorf-Astoria Hotel, New York, July 9-14, 1961.*

Atomic Shelter Seminar, *The Pennsylvania State University, University Park, Pennsylavnia, July 10-22, 1961.*

Joint Nuclear Instrumentation Symposium, *North Carolina State College, Raleigh, N. C., Sept. 6-8, 1961.*

Production Engineering Show, *Navy Pier, Chicago, Illinois. September 6-16, 1961.*

ISA Fall Instrument-Automation Conference & Exhibit, *Memorial Sports Arena, Los Angeles, Calif., Sept. 11-15, 1961.*

National Metal Exposition, *Detroit, October 23-27, 1961.*

First International Convention on Ionization of Air, Technical, Physical and Physiological Aspects, *Ben Franklin Institute, Philadelphia, Pennsylvania, October 16-17, 1961.*

National Frozen Food Distributors Assn., *Chicago, Nov. 6-10, 1961.*

Air-Conditioning and Refrigeration Institute (annual meeting), *The Homestead, Hot Springs, Virginia, Nov. 12-15, 1961.*

National Warm Air Heating and Air Conditioning Assn. (annual convention), *La Salle Hotel, Chicago, Nov. 13-16, 1961.*

National Electrical Manufacturers Assn. (annual meeting), *Traymore Hotel, Atlantic City, New Jersey, Nov. 13-17, 1961.*

National Assn. of Home Builders, *Exposition Center, Chicago, Dec. 3-7, 1961.*

Watch For These Articles Next Month!

✓ SYSTEM INTEGRATION CUTS BUILDING COSTS

by Gershon Meckler, Consulting Engineer. How dynamic integration of architecture and mechanical design, using dual purpose products, reduces the net energy input to the building . . . and so reduces building first and operating costs.

* * *

✓ NEW USES OF SCRUBBERS IN INDUSTRIAL GAS CLEANING

by G. T. Nicklin, Chemical Engineer, Western Precipitation Corp. Summarizes scrubbers in low, intermediate, and high pressure drop categories, and their performance characteristics.

* * *

✓ HUMIDITY AND DUST CONTROL IN LIGHTER-THAN-AIRCRAFT FACTORY

by A. E. Swindler, Manager, Plant Engineering Div., Goodyear Aircraft Corp. Problem of dust and humidity weakening fresh cement bonds. Capillary air washers and elaborate controls to the job.

* * *

✓ AIR CONDITIONING A SOLID PROPELLANT PROCESSING PLANT

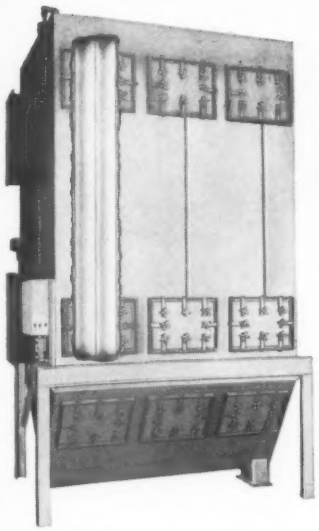
by W. J. Higgins, executive Staff Engineer, Rocket Power Div., Gabriel Corp. Close temperature and humidity control are a problem. Solution of the problem discussed in article.

* * *

✓ INDUSTRIAL HEAT EXPOSURE AND CONTROL

by R. Lemke, Mechanical Engineer. Series outlining sources of heat, effect on worker, and removing it for workers comfort.

NEW DUSTEX "INDUCTAIRE" FABRIC-FILTER DUST COLLECTOR



Dustex "Inductaire" Filter Collector, Model 20-8-3. Sizes to meet all capacity requirements. Equipped with suitable filter fabrics to handle any dust problem including high temperatures up to 550°. Model shown with 8' bags. Larger models equipped with 12' and 25' bags.

GENTLE BUBBLE-ACTION ELIMINATES THE "DUST TRAP"

- **more effective, shorter cleaning cycle maintains system volume with minimum fluctuation**
- **higher air/cloth ratios in less space greatly reduces first costs**
- **longer fabric life—no damaging shakers or blow-back mechanisms**
- **lower maintenance costs—dampers operate in clean air ducts only—no other moving parts—bag changes easier, less frequent**

Only gentle air action on the fabric—virtual elimination of trapped dust...that's the amazing combination achieved by "Inductaire" bubble-action, introduced by Dustex to reverse air cleaning. No violent shakers, no fabric-damaging friction of any kind...yet, each bag is thoroughly flexed, purging it of the dust usually trapped by reverse air collapsing. Resulting increases in air/cloth ratios, plus many other Dustex engineered features, add up to less space requirements, reduced first costs, lower maintenance and operating expenses. Now, the 99.9+ efficiency of filter collection is yours at savings never before possible!

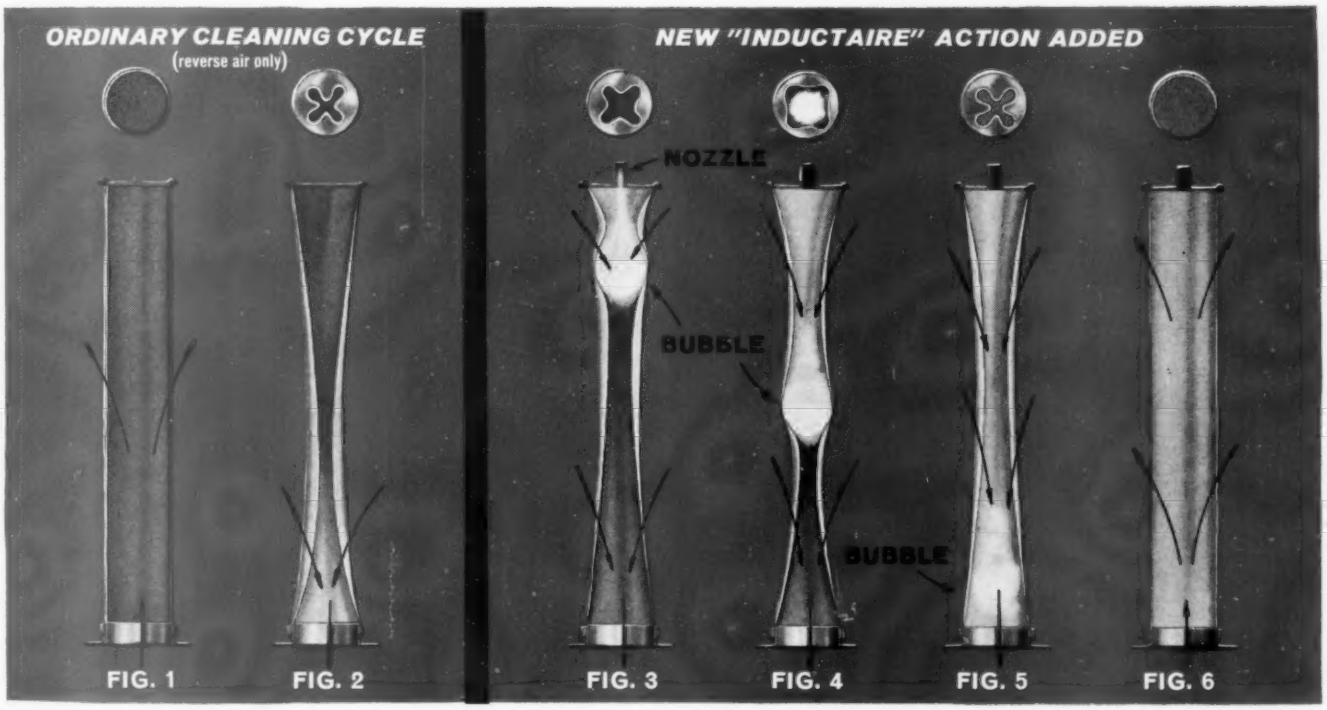


FIG. 1 Dust cake builds up to point where cleaning is required.

FIG. 2 Reverse air flows through fabric, collapsing tube in pleats until only small cone remains at bottom through which air can move. Dust cake is cracked by this action but much of it is trapped in upper portion of tube. This is the usual reverse air system used for many years in collectors capable of air/cloth ratios in the range of 2 cu. ft./sq. ft.

FIGS. 3 & 4 Addition of unique "Inductaire" nozzle in bag cap, increases air/cloth ratios up to 10 cu. ft./sq. ft. and higher. After usual reverse air cycle collapses bag, nozzle releases short pulses of air inducing additional air currents through the top of the bag, creating an air bubble that flows downward, opening the collapsed tube and purging the dust cake into the hopper.

FIG. 5 Reverse air flow continues, causing tube to again collapse producing further cleaning action on the fabric. Steps 3, 4, and 5 then repeat as many times as required (usually 3-5 impulses) for the dust handled.

FIG. 6 The brief cleaning cycle; about 20 seconds, is complete, with the tube back in normal filtering operation.

"Inductaire" represents the latest development by Dustex to offer the finest in filter and centrifugal dust collection equipment for every dust problem. Write for particulars on the complete Dustex line and engineering services ready to help you.

Dustex CORP.

P.O. Box 2520 • BUFFALO 25, NEW YORK

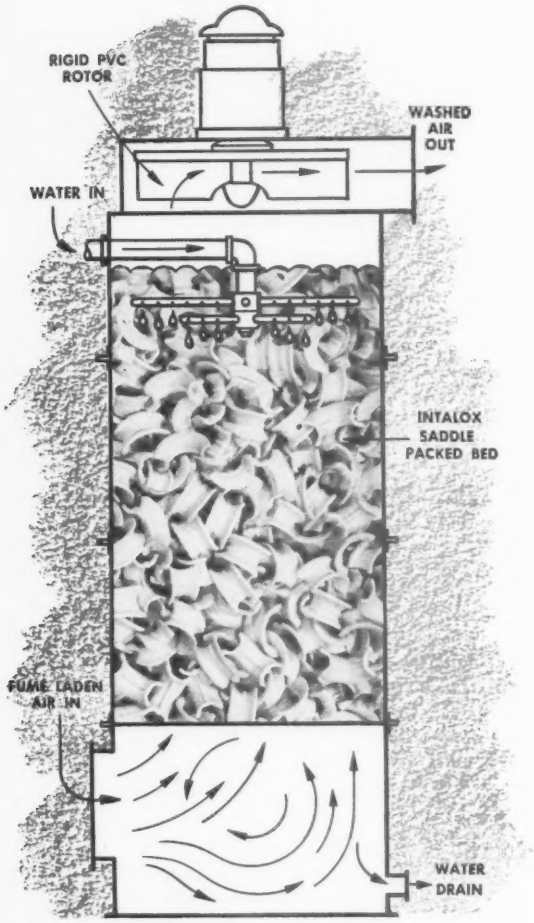
The company with the big name in dust collection

[For more information circle #15 on page 51 reply cards]

FOUR WAYS TO HANDLE F

Absorption of noxious fumes by wet bed scrubbers is generally accepted as the most satisfactory method where virtually complete fume removal is required. With the development of packings of high efficiency, such as Intalox Saddle Packing and Metal Pall Rings and improved liquid distribution methods, fume scrubbers of high capacity yet occupying little space and operating at low cost have become practical.

On these two pages are illustrated and briefly described both standard and custom-built fume scrubbing units of our manufacture. Full engineering data is available on request. U. S. Stoneware's Engineering Department will be glad to work with you in designing fume removal systems to meet your specific needs.



"CYCLONAIRE" Fume Washer

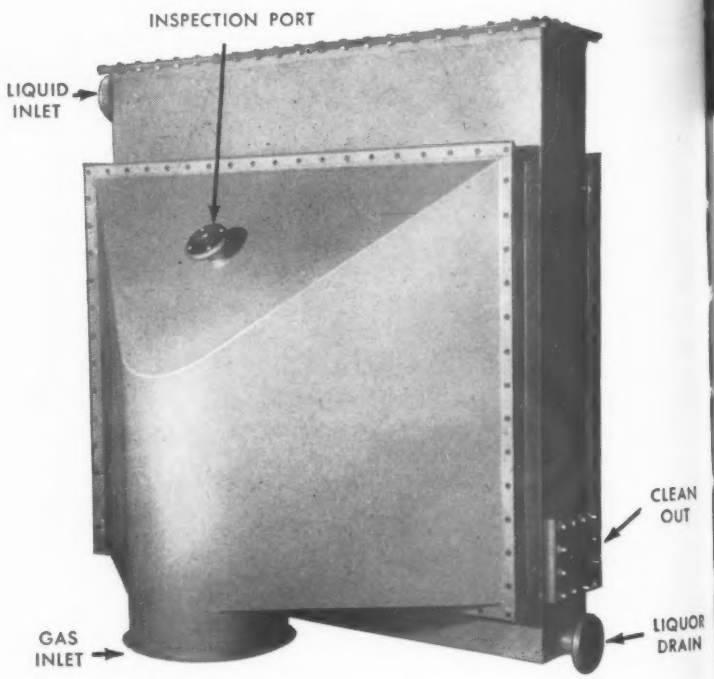
Designed primarily to handle relatively mild fume problems in laboratories, special departments, etc., the Cyclonaire is made in four sizes with rated capacities of 750, 1650, 3500 and 6000 cfm. It will effectively remove up to 99% of fumes (where the concentration of gases is 1% or less). The unit is available made either from fiber glass reinforced polyester plastic or from 12 ga. steel lined with 3/32" thick Tygon Sheet plastic. The rotor is rigid PVC. Shipped complete with motor and necessary packing.

The "Cyclonaire" can be equipped with mist or dust eliminators or provided with recirculating pumps. Two units can be arranged in parallel to handle additional cfm, or in series for heavier fume concentrations.

The "CROSS-FLOW" Fume Scrubber

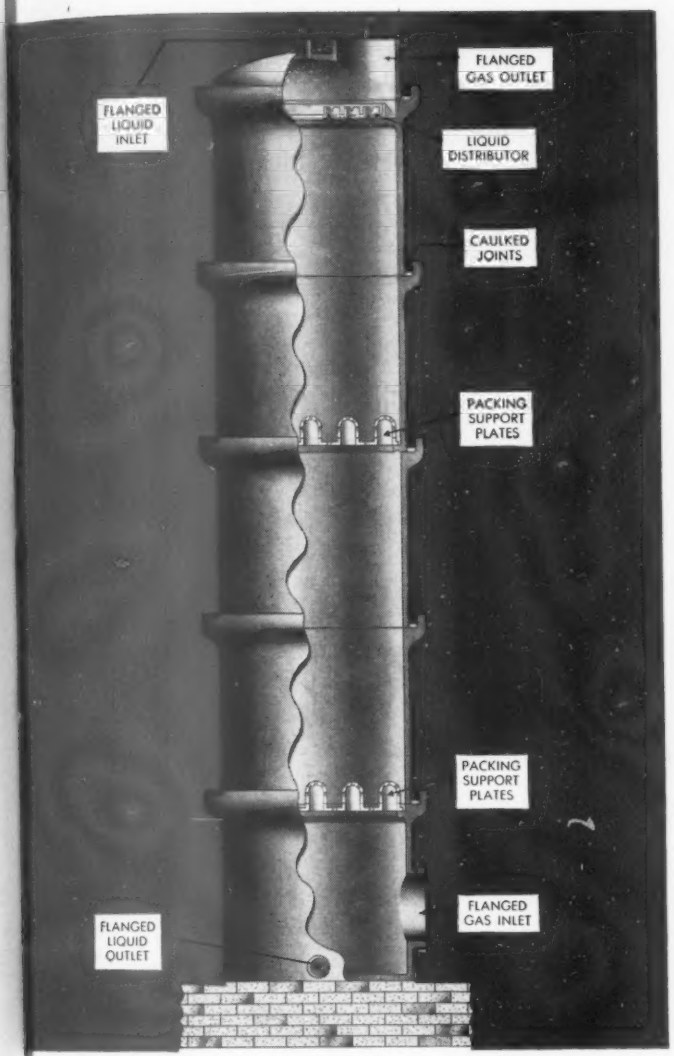
The "Cross-Flow" Fume Scrubber provides high efficiency in relatively small space. It is so designed that the gas flow and liquid flow are perpendicular to each other . . . the liquid flow vertical, gas flow horizontal. The effective liquid distribution over a cross-section area that is large in relationship to the thickness of the packed bed results in a highly active surface area capable of handling gases at high velocity rates with minimum pressure drop.

The "Cross-Flow" Fume Scrubber is built in six standard sizes with capacities ranging from 3,000 to 32,000 cfm. The unit is fabricated from heavy steel plate lined with 3/32" Tygon. Distributor is rigid plastic. The screen grid can be stainless steel or plastisol-covered wire mesh.



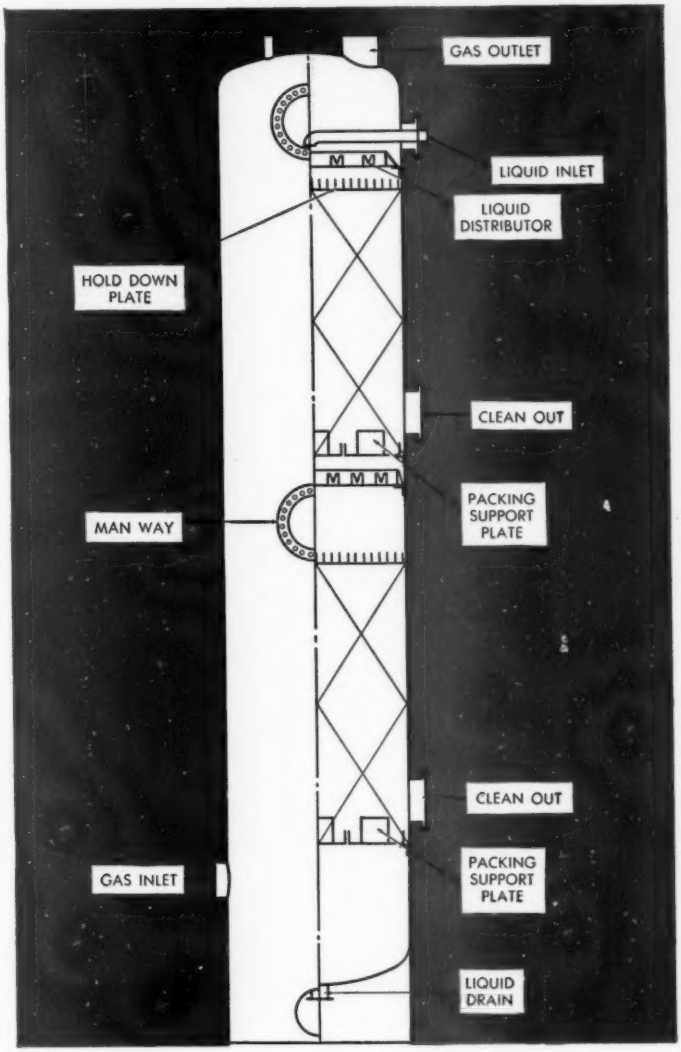
The unit illustrated above was designed for roof mounting, hence the gas inlet is located at the bottom. The unit, however, can be furnished with gas inlets located as desired.

FUME REMOVAL PROBLEMS



Ceramic Fume Washers

For some applications, fume scrubbers made from chemical ceramics represent the best and most economical approach. Ceramic fume scrubbers can be provided in diameters up to 48", in heights up to 60 feet or more. Ceramic support plates, ceramic distributors, and ceramic pipe and fittings complete a virtually universal corrosion-resistant fume removal unit. Standard towers are made with either bell-and-spigot construction or with cemented-on-metal flanges and are available in chemical porcelain, standard stoneware or "Ceratherm-550" heat-shock resistant stoneware.



Custom-built Metal Scrubbers

By far the largest number of fume removal applications involve the use of equipment custom designed and built to the user's specific requirements. The unit illustrated is typical of many such towers we have built in sizes ranging up to 8'-10' in diameter and as much as 80 feet high. The units may be lined with Tygon sheet lining or rubber, or unlined. Either metal, carbon, or ceramic support plates and distributors may be employed. Packing may be ceramic or carbon Intalox Saddles or Metal Pall Rings according to the nature of the gas and scrubbing agent.

Continued research in packed column technology enables U. S. Stoneware to offer fume scrubbers of most advanced design and proven efficiency. The results of our engineering investigations and our practical "know-how" are always available, with no implied obligation to design and operating engineers. Write Engineering Dept., U. S. Stoneware, Akron 9, Ohio, or one of our major branches.

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377F-3

[For more information circle #16 on page 51]

NEWS of the Industry

New Contamination Control Association Being Formed

A new Association has been incorporated to bring together into one technical group all the diverse sciences and arts devoted to contamination control in industry.

The new association, named the American Association For Contamination Control, will, according to its constitution, " . . . promote the science of contamination control for fabrication, cleaning, assembly, testing, inspection and use of contaminant-sensitive products."

The new association states that contamination control includes all contaminants, such as airborne particulate matter (solids), gases and the contaminants on surfaces of parts.

There is a great need for such an association, according to James Mildon, president of the new association and executive plant engineer, Lear, Inc. Mr. Mildon stated that there exists a need for standardizing contamination control, design of white room facilities, dust counting and dust monitoring. The new association will concern itself with these technical problems, and later on will promote a full-fledged symposium on contamination control and exhibition of equipment for contamination control, most likely in the Fall of 1961 or Spring of 1962, according to Mr. Mildon.

The Association will also further the development of "techniques for control of airborne contaminants in industry, hospitals, pharmaceutical manufacturing companies and areas where clean air is required for health and/or reliability."

Membership in the new Association is open to "any person having a professional interest in the design, operation, supervision of, or supply of equipment for contamination controlled areas."

Annual membership dues are $10.00. Corporate sustaining memberships are $100 per year.

Application forms for the new Association can be obtained by circling No. 200 on the pre-addressed, postage-paid card on page 51 in this issue of AIR ENGINEERING. *A copy of the constitution and bylaws of the Association will be mailed with the application form.*

Officers of the Association are:

President, James Mildon, Executive Plant Engineer, Lear Inc.

Treasurer, Chris Gort, Plant Engineer, Sperry Phoenix Company.

Secretary, Eugene A. Sloane, Editor, AIR ENGINEERING.

Vice President, Ed Casey, Plant Engineer, Rocketdyne Division, North American Aviation.

Vice President, Irving Kodel, Manufacturing Development Engineer, Sandia Corporation.

Vice President, Alvin Lieberman, Research Chemical Engineer, Armour Research Foundation, Illinois Institute of Technology.

Heat Pumps . . . In The News

At Allen-Bradley's new $15-million Milwaukee headquarters and research center, a new world's largest heat pump . . . 1,400 tons capacity. System uses heat from people, lights and business machines; no boilers or other fuel-burners used, according to consulting engineer George H. Volk.

At Masland Duraleather Co.'s new $1-million plant in Mocksville, N.C., what is claimed to be world's first centrifugal heat pump using air as heat source, has been installed. A 200 and an 80-ton heat pump provide heat and cold for comfort and process.

Masland and Allen-Bradley heat pumps by Carrier.

In Bensenville, Ill., (near Chicago) the much-publicized York heat pump in the Flick-Reedy plant, using air-to-air exchangers, had been checked out against conventional systems, savings projected to $5,000 annually with heat pumps. Reports the owners, these savings have been realized.

$173-Million For Air Conditioning

According to Chain Store Age and the Air Conditioning and Refrigeration Institute, the nation's chain stores will spend $173-million for air conditioning in 1961, much of it to air condition existing stores.

Fume Exposure For Lift Truck Driver

Tests conducted by the Franklin Institute, State of Pennsylvania for Oxy-Catalyst, Inc., proved the amount of carbon monoxide and hydrocarbons a driver of a gasoline-powered lift truck is exposed to in operating a vehicle indoors, with or without ventilation.

Driver of the test vehicle was exposed to the following carbon monoxide and hydrocarbons: sample A, garage closed and the truck standing still lifting a load; sample B, garage well ventilated and truck operating; sample C, garage well ventilated and truck standing still lifting a load.

	Carbon Monoxide PPM	Hydrocarbons, PPM
Sample A	137	17.0
Sample B	13	4.4
Sample C	28	2.2

Maximum allowable concentration for CO in the breathing atmosphere is 100 PPM for eight-hour exposure (American Industrial Hygiene Association Standard Sheet, dated September, 1956). There is no clear identity for the various hydrocarbons in auto exhausts, and consequently no maxi-

(Please turn to page 18)

. . . in Chicago's new Exposition Center

Impressive main entrance to Chicago's Exposition Center, magnificent new mecca for exhibitors and conventioneers. Inset, right, shows one arrangement of the many Dorex filters.

996 DOREX AIR RECOVERY FILTERS SAVE 800 TONS OF AIR CONDITIONING CAPACITY

. . . and provide relief from the irritant-heavy atmosphere of shows, conventions, exhibits

In the new 34 million dollar Exposition Center at McCormick Place, 996 high efficiency Dorex activated carbon filters—the largest installation of its kind in the world—purge recirculated air of irritants and purify it for sanitary re-use in the Center's vast air conditioning system.

But from the Center's profitable-operation point of view, Dorex air recovery is even more important. Serving 350,000 square feet of exhibition space, the filter system will have almost one million cfm recirculated through it . . . representing a saving of 800 tons of air conditioning capacity at an installed cost of approximately $360 per ton, for a total saving of over $300,000! And further tremendous savings in operating costs will be realized!

Thirty years of research, development, and application, plus a systematic replacement service that ensures the continuous effective operation of every installation, make Dorex the best method of AIR RECOVERY and ODOR CONTROL.

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dorex® air recovery

. . . the most experienced professionals in air recovery and purification.

[For more information circle #11 on page 51]

Research
Responsibility
Results
WHEREVER GASES ARE
CLEANED OR HANDLED...
Aerotec Industries offers more than a half century of world wide experience in engineering and manufacturing equipment for efficient and economical cleaning and handling of air and gas. Single responsibility for complete systems, from design to final installation, assures management that overall performance guarantees will be met. Write for information on the products of interest.
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Divisions: INDUSTRIAL • Electrical and Mechanical Dust Collectors • Wet Collectors • Fans • Fan-Stacks • Blowers • Gas Scrubbers • Air Preheaters • Curtain Dampers.
AIRCRAFT EQUIPMENT • Advanced electro-mechanical equipment for the aircraft, missile and nuclear industries.
AEROTHERM • Aircraft lounges, passenger and crew seating.

NEWS

(Continued from page 10)

mum allowable concentration limits for hydrocarbons can be noted. This test proves the necessity for adequate control equipment on all engines operated indoors and/or adequate ventilation.

Plan Central Heating And Cooling System

The East Ohio Gas Co. has proposed a 5 to 10-million dollar plant to supply steam heating and cooling for office buildings, hotels and apartment houses in an Urban Renewal Project.

The company's engineers said there would be enormous economies in operating and maintenance costs, capital expenditures, and building owners could rent space normally used to house heating and cooling equipment.

The plant would be modeled after a system now being constructed in Hartford, Conn., by the Hartford Gas Co. (See AIR ENGINEERING, March, 1961, page 16.)

Air Pollution Is No Respecter of Boundaries

A move by the Los Angeles County Board of Supervisors to get all California counties to adopt strict Los Angeles smog laws was adopted by the board. The reason: smog comes from surrounding areas as well as from inside the county.

In Ohio, another tack was taken by Gov. Michael V. DiSalle, who believes the city, not the state, should govern air pollution, on the grounds that air pollution is a local, not a state problem, and local peculiarities and needs should take precedence. While admitting of the seriousness of the problem, the governor stated that "The cost to a community of severe restrictions on industry, coupled with an expensive air pollution abatement program, must be balanced against the degree of air purity which the community can expect." Issue came up over installation of oxygen process at the Cleveland plant of Republic Steel Corp.

[For more information circle #20 on page 51]

Minuteman Gets New White Room

A 40,000 sq. ft. controlled atmosphere or super-clean room protects electronic parts of the Minuteman Missile from contamination by dust, temperature variation and other atmospheric conditions, according to R. V. Miraldi, plant engineer for Radio Corporation of America's Surface Communications Division. RCA is installing the White Room in its Cambridge, Ohio plant.

The problem of contamination of everything from liquid oxygen valves, electronic controls, biologicals and missile parts in general, was mentioned in a lengthy article in the Wall Street Journal of May 5, 1961. Article discussed in some detail need for industrial contamination control in dust-sensitive product assembly. WSJ brings up the interesting fact that 20 percent of cost of a missile is traceable to contamination control "according to Byron G. McNabb, Convair Div. general manager of their Cape Canaveral testing facility."

Await OK For Changes In Construction Bidding

A reply to a letter to U. S. Attorney General Robert Kennedy is being awaited before starting operation of the "Construction Bidding Practices Conference of Southern California."

Accompanying the letter are two changes in the rules and regulations to eliminate any possible collusion among the bidders.

The first change provides that where the general contractor is signatory to the agreement and is requesting bids of subcontractors they will not have to abide by all provisions of the conference agreement and rules and regulations, but will provide that the sub-bidder submit his bid four hours ahead of time as the minimal condition for submitting the bid.

Sub-bidders not signatory to the procedure will not have to put their bids in the conference office or sign the agreement.

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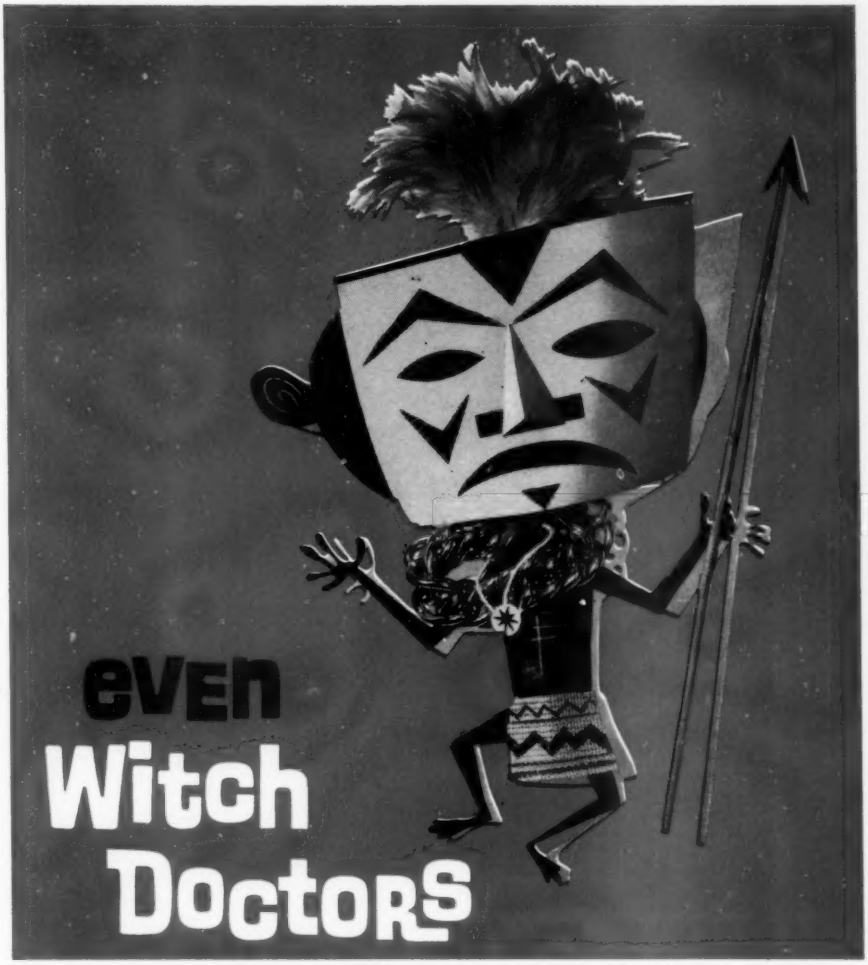
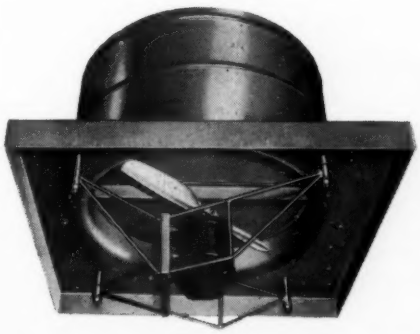


prescribe
HARTZELL ROOF VENTILATORS
for efficient, economical
exhaust of heat, smoke and fumes



You will find Hartzell Roof Ventilators wherever industry has need for a high efficiency ventilator which will operate year after year with a minimum of maintenance. Vertical discharge types such as the Hartzell Vertijet (shown at left) are simple, fool-proof, easy to install and economical to operate. Other types are also available, including a unique reversible ventilator which can be used for exhaust or intake at the flip of a switch.

For complete details, just give your nearby Hartzell field engineer a call. You'll find him listed in the Yellow Pages or in the Hartzell catalog in Sweet's Plant Engineering and Industrial Construction Files.

Hartzell PROPELLER FAN COMPANY
Division of Castle Hills Corp. • PIQUA, OHIO
(HARTZELL)

[For more information circle #19 on page 51]

SPENCER Vacuum

Assembly and Gaging Dept., Miniature Precision Bearings, Inc., Keene, N. H.

KEEPS "WHITE ROOMS" WHITE

Dirt and dust are strictly bad news around gaging or assembly areas of a company producing precision ball bearings. Every possible precaution must be taken to assure an absolutely dust-free atmosphere in the "white rooms".

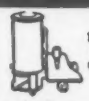
That's why, at plants like this modern Miniature Precision Bearings, Inc. factory, you'll find SPENCER vacuum cleaning systems providing *sure* sanitation.

Whether your cleanliness requirements are critical . . . or whether *convenience* and *economy* of maintenance are primary, you'll find a SPENCER system the answer to your needs.

Write for complete information on SPENCER installed vacuum cleaning systems or request a piping layout to meet *your* particular requirements.

The SPENCER TURBINE COMPANY
HARTFORD 6, CONNECTICUT

OTHER QUALITY SPENCER PRODUCTS



PORTABLE VACUUM CLEANERS

PNEUMATIC CONVEYING SYSTEMS

BLOWERS

[For more information circle #18 on page 51]

NEWS

(Continued from preceding page)

The second change is controversies between signatories will go to arbitration under the laws of the state of California which provide procedure for that method of settlement. Decisions obtained through the California arbitration procedure are appealable to the courts. Therefore, the courts would have the final say, not the construction industry.

Air Cleaning . . . New Installations

Hamilton, Ont., Can. — $900,000 precipitator on Steel Co. of Canada, Ltd.'s new open hearth furnace.

Cleveland, Ohio—Ford Motor Co. Brook Park Foundry, baghouse of 1,872 bags, each 14 ft. high, plus two more of 4,608 filter bags each this summer to follow . . . for collection of casting-cleaning dust. System replaces a precipitator.

Philadelphia, Pa.—Betz Laboratories, Inc., for dry mixing of powdered chemicals, ejector-venturi fume scrubbers for dust collection. Collectors by Schutte and Koerting Co.

Vancouver, B.C., Can.—Commonwealth Construction Co., Ltd., an impingement type dust collector for final cleanup on dust handling system in asphalt plant rock dryer. Scrubber by Western Precipitation Div. of Joy Mfg. Co.

Help For Research From Government and ASHRAE

Northwestern University has received a grant of $648,161 from the National Institutes of Health, U. S. Public Health Service, for expanded research facilities in bio-engineering and biochemistry. A portion of the research will be civil engineers studying environmental control, including atmospheric pollution.

ASHRAE Donation

American Society of Heating, Refrigerating and Air-Conditioning Engineers has announced donation of its $150,000 controlled environment facility to the Kansas State

Environmental Research Center, newly-established by the Kansas State University of Agriculture and Applied Science at Manhattan, Kan.

Arizona Won't Find Polluters

Arizona Senate killed a bill providing for $35,000 to match the same in Federal funds for smog study, on basis that they know what causes air pollution, so why waste money to find out.

Solons, said Smith Griswold, of Los Angeles Air Pollution Control Department, erred in that it's one thing to know what **causes** smog, another to find out **who** causes it, and for this latter bit of detective work, instruments are needed. Arizona solons killed the bill for money to buy instruments.

Cost Analysis . . . Heating & Cooling

Another chapter in the struggle to bring this business of big building climate control to the level of accountability (capable of being accurately pre-costed) has been written by Owens-Corning Fiberglas Corp.

This firm has developed a system called Dividend Engineering, which assists in accurate determination of the part played by insulation in the dollars and cents of air conditioning and heating equipment. The analysis takes into account factors such as cost of equipment and energy (gas, coal, electricity, sanding devices, construction costs, cost of money, depreciation, and insurance).

Systems helps determines degree of insulation thickness best for the building, the climate, the people and the climate control system.

Bid Depository Liquidated

Arizona Bonded Bid Opening Service, a bid depository in operation nearly three years and regarded as one of the more successful bid depository operations in the country, is now undergoing a final liquidation.

Nearly 90 percent of the plumbing, heating, and air conditioning

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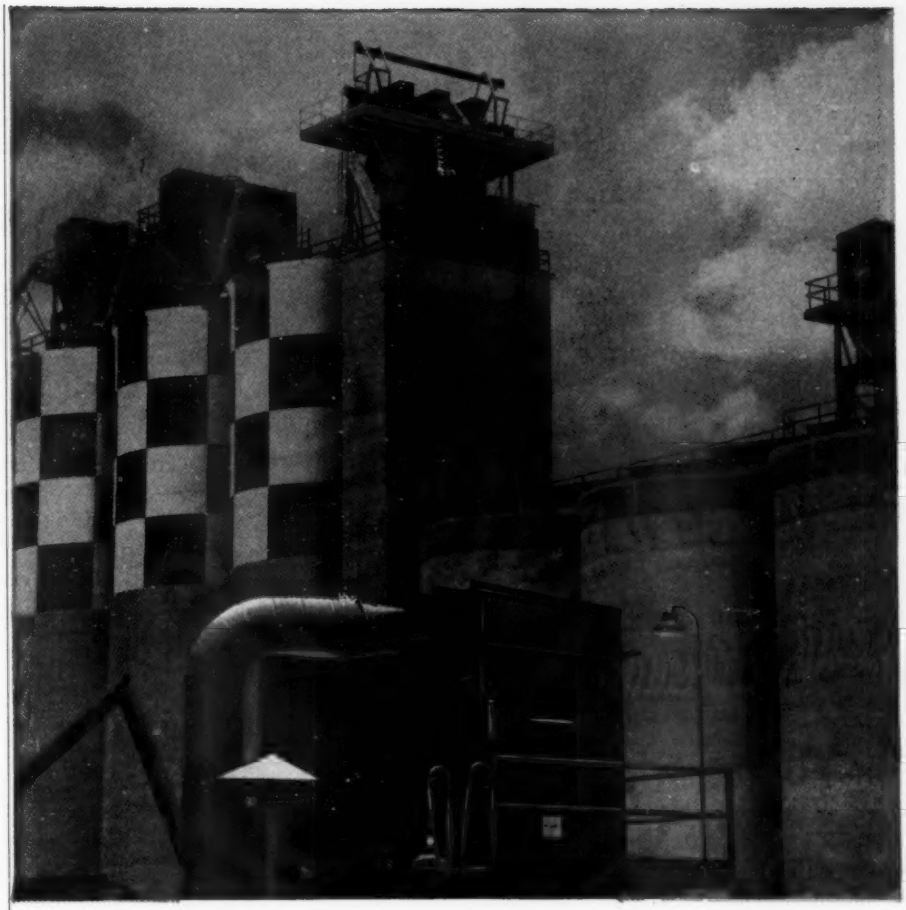


Performing a TOP JOB...
The MIKRO-PULSAIRE
DUST COLLECTOR

Installed at the Hawaiian Cement Company's new plant at Barber's Point, Oahu, you'll find a total of nineteen MIKRO-PULSAIRE Dust Collectors, four of which are pictured above.

Because it has no moving parts . . . internally or in the gas stream . . . the MIKRO-PULSAIRE has proved ideally suited to handling highly abrasive materials such as cement. Other features to be considered are its record of 99.9% *plus* recovery, and high air-to-cloth filter ratio. Our Hawaiian installation provides a total filtering capacity of 329,928 cfm. Whatever your requirements, the MIKRO-PULSAIRE can deliver a top job for you, economically and with maximum dependability.

MIKRO-Products
PULVERIZING MACHINERY COMPANY
1 Chatham Rd., Summit, N. J.
A Division of American-Marietta Company

PROCESSING SYSTEMS
GRINDING CONVEYING COLLECTING

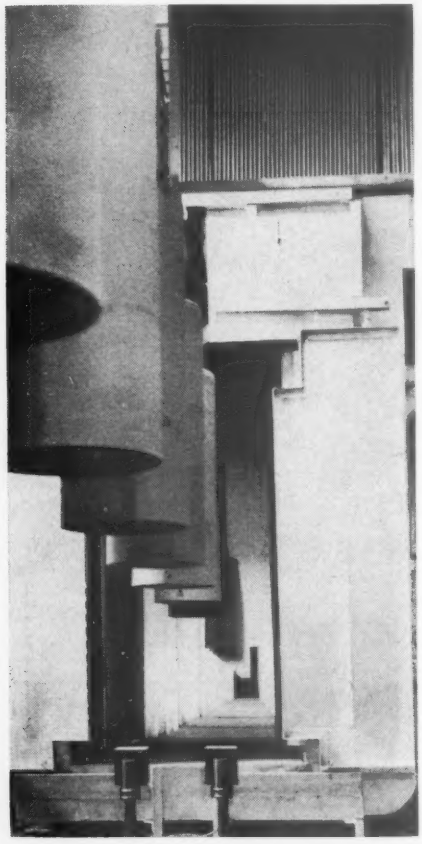
REPRESENTED THROUGHOUT THE WORLD IN SALES, SERVICE AND MANUFACTURING FACILITIES.
[For more information circle #21 on page 51 reply cards]

NEWS of the Industry . . .

(Continued from preceding page)

contractors in the Maricopa county area reportedly had participated in the plan at one time. However, through 1960 the bid depository system had deteriorated and before the end of the year the decision was reached to liquid the setup.

Principal reasons advanced for the failure of the bid opening service according to those participating in it, emphasized a failure to put together a strong contractor organization to hold the bid service participants in line, and the hostility of many general contractors to whom the bids were submitted.



Above: Radiant heating furnace without doors . . . in their place, to keep the conveyor system running continuously, air curtains are used.

Look Daddy . . . . . No Doors!

A 310 ft. long radiant furnace heating up to 1800°F to fuse glass linings to water heaters has been put into operation at the A. O. Smith Corp., Kankakee, Ill.

Carried continuously on an overhead conveyor system, the water heaters are passed through an air curtain into a preheat zone, a heating zone, and a cooling zone and leave the furnace through another air curtain without having to stop the process by opening doors.

According to the company, the new $300,000 installation will increase production from 52,000 to 66,000 water heaters per month.

Federal VS Local Air Pollution Control

"Together We Can Check The Blight Of Air Pollution," a 20-page booklet by the John Wood Co., Air Pollution Division stresses that because of each community's different meteorology and topography, air pollution control should remain at the local level with a working partnership between government and industry to support local authority.

Proposal made by the John Wood Co. includes:

- U. S. Public Health Service concentrating on medical research of polluted air on the public, withdrawing from air pollution technical services, and research and development projects.
- Legislation permitting industry expenditures for air pollution control equipment to be current operating costs.
- Federal government loans to small business for initial investment of air pollution control equipment.
- Government and industry scholarship program for selected individuals with Bachelor of Science Degree to study courses necessary for understanding air pollution problems. Completion of program would lead to Master of Science Degree.
- Use existing, non-profit Air Pollution Control Assoc. as a nucleus to coordinate air pollution abatement activities on the national level, yet maintain control at the local level.

To receive a copy of the booklet, circle #168 on the postage-free reply cards on page 51.

Ventilation News...

Commercial Melting Of Uranium-Contaminated Ferrous Metal Scrap

From a study by R. H. Starkey, M.S., J. W. McKelvey of National Lead Co. of Ohio, B. J. Held, Atomic Energy Commission, and E. L. Alpaugh, National Safety Council, they report adequate ventilation is a more desirable means of controlling dust exposures than the use of respirators.

For operations lasting an extended duration an efficient local exhaust system should be installed on the smelting furnace. Properly fitted metal fume type respirators offer adequate temporary protection for other than a permanent type operation. Also recommended, protective clothing and periodic spot air surveys.

Cadmium Exposures In Silver Soldering Operations

By G. H. Vance, B.S., Bureau of Industrial Hygiene, Connecticut State Dept. of Health.

The probability of cadmium and cadmium oxide fume concentrations increases with the use of high temperatures as found when oxyacetylene torches are used. Operating technique and size of pieces were also found to be factors in the production of atmospheric concentrations of cadmium.

In general, mechanical exhaust ventilation is recommended for all oxyacetylene silver soldering operations and may be advisable on some gas-air or resistance heating units depending on the evaluation of conditions found.

Use the Communications Center, page 51, to receive more information about any product advertised, any new literature or new product described. Circle the number on the postage-free card that refers to the item of your interest, add your name and address and mail.

[For more information circle #22 on page 51]→

AGROUND: A man-made overcast pouring from this paper mill's stacks could be a dangerous navigational hazard to aircraft at an adjacent metropolitan airport.

ALOFT: Visibility unlimited! No smoke . . . no hazard . . . no complaints . . . thanks to the pre-determined, guaranteed performance of Koppers Electrostatic Precipitators.

Koppers—a leading manufacturer of gas cleaning equipment for industry.

**Facts available on request*

KOPPERS®

ELECTROSTATIC PRECIPITATORS

Engineered Products Sold with Service • Baltimore 3, Maryland

ARI Says '60 System Installation Up 12% . . . Boosts Commercial Market

Total 1960 large system air conditioning installation cost is estimated at $800,810,000, compared with $716,570,000 in 1959.

With large building construction on the upswing, ARI says, "large system installation offers one of the greatest potential fields for expansion of the industry . . . many new applications being developed in industry, research, medicine, and national defense. Much electronic equipment, for instance, could not operate without mechanical cooling."

Bay Area Oil Refineries To Spend $8 To $10-Million On Air Pollution

Spending will be completed by 1962 to comply with anti-industrial smog Regulation 2. This in addition to more than $10-million spent prior to the adoption of the Regulation in May, 1960.

Under full compliance, a 60 to 80 percent reduction in dusts and droplets, plus reduction in sulfur oxide effects is expected.

Navy Awards Million Dollar Plus Contract For Nuclear Sub Precipitators

Approximately 300 air-cleaning precipitators with guaranteed efficiencies of 95 percent will be delivered to the Navy between 1961 and July, 1962 by Research-Cottrell, Inc.

Defense Department Spent $90-Million For Air Conditioning New Facilities In Fiscal '60 - '61

Plus the $90-million for new facilities, as much as $21-million will have been spent for air conditioning existing facilities, divided among the three services as follows: Air Force...$12 to $15-million; Army...$3½ to $4-million;

According to a government spokesman the importance and necessity of air conditioning is gaining greater acceptance throughout the armed forces.

Computer Has "Designs" On Engineers

Shell Oil Co. has had a chemical plant designed by a computer more cheaply, rapidly and efficiently than a team of engineers could do in a year. The computer design is a half million dollars less than the engineers' design and expected to cut production cost of the chemical by 5 to 10 percent.

The computer was fed the basic chemicals to be produced, reactions needed, variables as cost, temperature, pressure requirements, safety factors, air pollution limits, and even local zoning laws and came up with a complete factory design.

Penn Controls Acquires Electronic Firm

Through an exchange of stock Penn Controls acquired Pioneer Electric and Research Corp. Pioneer recently completed controlled atmospheric conditions for production of hermetically sealed photocells and specialized electronic components.

1960 School Construction Up 6.9 Percent Over 1959

Data based on U.S. Dept. of Commerce, Bureau of Census, monthly *Construction Reports*, reports the total 1960 public and private educational construction was $3,400-million and 1959 was $3,181-million.

Take the cost out of fume and odor control!

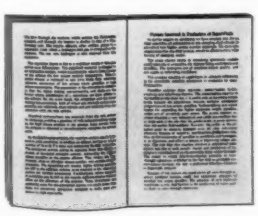
Modern advances of Catalytic Oxidation provide economical method for Air Correction

Heat and energy recovery from catalytic oxidation of fumes can often take much of the cost out of air control equipment. Catalytic Combustion, founded in 1950, has pioneered the development and application of catalytic oxidation systems for complete, economical elimination of industrial gaseous emissions which contribute to air pollution.

Catalytic's systems draw fumes from processing equipment, and pass the fumes through a circulating fan, discharging them through the catalyst element. With the catalytic system, "flameless" combustion takes place, and the heat needed is only 500° to 650° F., depending on the fume concentration. The resulting odor-free, color-free gases are then available for heat recovery, re-use in the processing equipment, or discharge to stack.

BTU's are valuable. Many fume streams have high potential fuel energy. In some processing applications, the recovery of this BTU value in dollars will pay for the equipment in a matter of months. Values too, in plant safety, employee morale, healthful, more pleasant working conditions, and improved community good-will can be measured in benefits to the firm employing truly effective fume and odor elimination.

Catalytic Combustion elements are built to standard sizes and complete systems are custom engineered to maximum effectiveness.



Learn the facts *about Heat Recovery and Air Correction... write "Department D" for our brochure.*

CATALYTIC COMBUSTION CORPORATION

4725 Fourteenth Street • Detroit 8, Michigan

A SUBSIDIARY OF UNIVERSAL OIL PRODUCTS COMPANY

[For more information circle #23 on page 51 reply cards]

USEFUL INFORMATION
on
Activated Charcoal
for High Percentage Air Recirculation and Odor Control

Bring your files up to date with these bulletins on activated charcoal. Just clip this ad and mail it to us.

- ☐ Activated Charcoal for Air Purification
- ☐ How Activated Charcoal "Traps" Odors
- ☐ Air Purification by the Black Magic of Activated Charcoal
- ☐ Fresh Air Costs Money
- ☐ Capacity of Activated Charcoal for Specific Vapors
- ☐ Hospital Odor Control
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- ☐ Air Purification with Activated Charcoal Filterfolds

Activated charcoal acts as a positive molecular sponge which adsorbs gases, vapors, irritants, toxic substances and smog. It enables you to engineer for high percentage air recirculation at low cost.

These and many other bulletins on all applications of activated charcoal are available to you. Give us the details of your application and we will supply specific data and samples.

We supply a complete line of activated carbons for every purpose; design and prefabricate air and liquid purification, separation and recovery systems. Barnebey-Cheney, Dept. T-1, Columbus 19, Ohio.

Barnebey Cheney

[For more information circle #24 on page 51]

Letters

New White Room Group Being Organized

Editor:

I noticed in the February issue of AIR ENGINEERING that an invitation is extended to Engineers and others interested in "White Room" design and/or operation, to join with others interested in this subject, to exchange mutually helpful information and ideas.

I am interested, and would like more information about the proposed activities of this group, and costs, etc.; and what I can do that will be of real assistance in accomplishing the objectives you have in mind.

Besides being a "Charter Subscriber" to AIR ENGINEERING, my work as a Consulting Engineer in the design of "Clean Rooms" and "White Rooms" for The Air Force and for Industry brings me in close contact with many of the problems involved.

D. K. Coyle
Electrical & Mechanical Engineer
Sacramento, California

Editor's Note:
See editorial, page 5, and
Circle #200 for more information.

"The Economics Of Factory Air Conditioning"

Editor:

First, let me compliment Mr. Eugene A. Sloane on his very fine article, "The Economics Of Factory Air Conditioning," in the February issue of AIR ENGINEERING. We feel that this article and the material in it can be put to good use in our service area, the scope of this use depending upon answers to the following questions:

1. Are re-prints of Mr. Sloane's article available, and if so, what would be the price for the same?
2. Are additional copies of the February issue still available in reasonable quantities of, say, 25 to 100?
3. Will you grant us permission to use excerpts from Mr. Sloane's article, particu-

larly the tables, charts, and the "Yardsticks to Determine If Air Conditioning Will Pay In Your Plant," "16 Reasons Why You Should Air Condition Your Factory," and "14 Practical Ways to Reduce Cooling Costs?"

C. C. Shotwell
Philadelphia Electric Co.
Philadelphia, Pa.

Editor's Note:

To receive a reprint of this article **Circle #172 on page 51.**

Industrial Ventilation Manual

Editor:

I am a subscriber to your publication. I would like to know if you have a publication on the various phases of ventilation?

W. Anderson
Mamaroneck Sheet Metal Corp.
Mamaroneck, New York

Editor's note:

You might be interested in an excellent manual of Industrial Ventilation which you can buy through Mr. James Barrett, Ventilation Engineer, Michigan State Department of Health, Occupational Health Division, Lansing, Michigan. This manual sells for $4.00. It is a real "bible" of information on Industrial Ventilation and you should certainly have a copy. Write to Mr. Barrett directly for your copy.

Articles Are Informative And Well Written

Editor:

The articles on factory air conditioning in your February issue (Editorial, "The Case For Factory Air Conditioning" and feature article, "The Economics Of Factory Air Conditioning") are very informative and very well written. I would appreciate receiving more detailed information on types of equipment used for this application. Thanks!

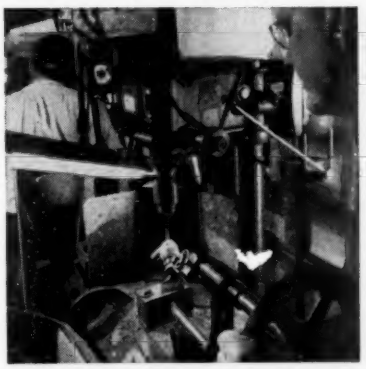
P. C. Jain
Consulting Engineer
Ellerre & Co.
St. Paul, Minnesota

dust control with 25% savings in fuel bills for Dr. Grabow

A demonstration of WHEELABRATOR'S

VITAL VALUES

A Wheelabrator Dustube cloth tube type Dust Collector ventilates all dust-creating operations at Sparta Pipes, Inc., Sparta, N.C., manufacturer of Dr. Grabow Pre-Smoked Pipes. Replacing an old, open dust bin, the control system not only solved the dust problem, but also cut fuel bills at least 25% through recirculation of heated clean air, and reduced building maintenance costs 15%. The high filtration efficiency of the Wheelabrator Dustube is just one example of the many Vital Values incorporated in all Wheelabrator systems which bring bonus benefits and multiple savings. For your dust and fume control problems investigate Wheelabrator. Write for bulletin 372 D.



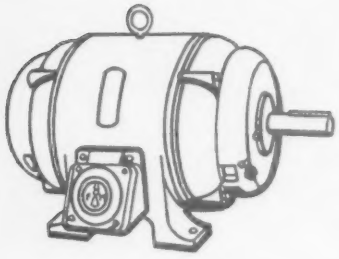
Three floors of manufacturing operations are ventilated by a Dustube Dust Collector that has brought 5-way savings to Sparta Pipes, Inc.

VITAL VALUES FOR INDUSTRY

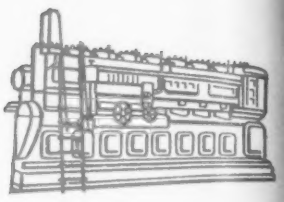
WHEELABRATOR DUST AND FUME CONTROL

WHEELABRATOR CORPORATION, 498 S. Byrkit St., Mishawaka, Ind.
In Canada, WHEELABRATOR CORP. of Canada, Ltd. P.O. Box 490, Scarborough, Ont.

[For more information circle #25 on page 51]



Electric VS Gas Drive For Big Building Cooling



Case history of air conditioning added to existing factory of the Black & Decker Mfg. Co. points up pros and cons of both sources of power as cooling compressor drive. Analysis by Austin Co.

by John E. Norris*
Industrial Fuel Dep't,
Baltimore Gas & Electric Co.

THIS INSTALLATION, completed in mid 1960, is unique in its use of a single large natural gas fueled internal combustion engine as the prime mover for a centrifugal compressor. It is believed to be the largest single gas engine unit for air conditioning in this country.

Mr. John H. Wolfe, Jr., Manager, Plant Engineering, who headed up the project for Black & Decker, had the Baltimore Gas and Electric Company submit budget estimates for both system costs and operating costs to provide for alternate consideration of electric drive, gas engine drive, and steam operated absorption equipment.

Based on these preliminary figures, the absorption system was eliminated from consideration because of higher operating cost and because additional boiler capacity would have had to be provided. On the other hand, the preliminary figures for gas engine drive centrifugal compression looked so attractive that Black & Decker engaged the Austin Company of Cleveland to make a detailed engineering design and to carry out cost studies for the gas engine and electric drives. The Austin Company developed the cost analysis as shown in Table I.

The first significant item in the tabulation shows that the higher first cost of a gas engine drive was offset by the higher cost of electric transformer and substation equipment necessary for the 800 hp electric compressor motor. A favorable summer gas rate for air conditioning allowed approximately $4,500 annual saving in energy costs for the gas engine over the electric motor drive and maintenance for the engine and other costs reduced this to about $2,600 net.

In view of this saving, the Austin Company recommended the gas engine driven centrifugal compressor and Black & Decker decided to proceed with this system. The Austin Company was awarded the contract to design and install the air conditioning system.

The refrigeration machine consists of a 776-ton centrifugal compressor driven at 8,500 rpm by a V-12 825 hp natural gas engine operating at 1,100 rpm through a geared speed increaser. The engine is cooled through a heat exchanger by water from the system cooling tower which was provided with the necessary additional capacity for this purpose.

(Please turn to page 24)

**John E. Norris, Jr., Engineering Representative, Senior, Industrial Fuel Department, Baltimore Gas and Electric Company, is responsible for developing the sale and use of natural gas for air conditioning. Mr. Norris has a BSME from Duke University and has been active in developing air conditioning load, both gas and electric, for the utility for the past 14 years.*

Fig. 1: Left, interior view of Black & Decker plant at Towson, Md. Air distribution ducts can be seen above the third row of lights.

TABLE I—INSTALLATION COSTS

	Electric	*Gas*
Air Conditioning Equipment Installed Cost	$470,000	$496,000
Substation, Wiring, etc.	50,000	24,000
	$520,000	$520,000

ANNUAL OPERATING DATA

	Electric	*Gas*
Gas Consumption—Compressor (Mcf—1030 Btu)	..	9,040
Electric Consumption—Compressor (kwh)	658,000	..
Electric Consumption—Auxiliaries (kwh)	625,000*	622,000*
Electric Demand (total kw)	866	286
Substation Required (kva)	1,500	500

ANNUAL OPERATING COSTS

	Electric	*Gas*
Gas Energy Cost—Compressor	$ ..	$ 6,570
Electric Energy Cost—Compressor	11,030	..
Electric Energy Cost—Auxiliaries	7,790	7,820
Operating Labor	605	605
Refrigerating Machine Maintenance	1,200	1,000
Gas Engine Maintenance	..	2,030
Total Annual Operating Cost	$ 20,625	$ 18,025

Annual Saving By Using Gas — $2,600

**Includes transformer losses.*

Fig. 2: Left, aerial view of Black & Decker plant. Equipment room can be seen at right-hand end of main plant building. Water tower is behind this corner.

Electricity vs Gas Drive

(Continued from page 22)

One significant feature of the engine cooling system is a large cooling water reservoir provided with the engine which allows the engine to be run at no load for testing and off-season inspection without circulating water from the cooling tower. Operating periods of up to 30 minutes with the engine uncoupled from the load are permissible with no danger of overheating if engine speed is limited to about 500 rpm.

A natural question would be, "What about engine noise?", and this was of great concern to Black & Decker whose plant is close to residential areas. The use of a silencer on the engine has reduced engine exhaust noises to a low order sound of rushing air. Generally, outside the building, no operating noise is noticeable above that of the conventional water tower.

Space for the refrigeration equipment was not available within the existing building without extensive alteration, so a 22 ft. by 130 ft. extension was constructed on the west end of the building to house the refrigeration machine and other associated equipment. The equipment requires about 22 ft. by 52 ft. of this area, and the remainder houses conditioning equipment for cleaning and conditioning a coolant solution used in certain grinding and machining operations on the production line. Enough room was made available in the refrigeration equipment room to house the 500 kva packaged transformer and substation unit which supplies power to the air conditioning fans, chilled and condenser water pumps, and other miscellaneous loads.

The new structure can be seen at the right-hand (west) end of the aerial photo in Fig. 2. Fig. 3 shows the equipment room interior. Control consoles are seen to the left of the condenser-chiller shells.

The buildings to be conditioned consisted of three, connected, factory type buildings 195 ft. wide and 695 ft. total length. Air conditioned area totals 186,000 sq. ft., of which about 28,000 sq. ft. is engineering and office space. The building is mainly a single story structure with a second floor at the east end and basement at the west end, taking advantage of the sloping terrain on which the building is located.

The west end of the building has a particularly high internal heat gain from gas-fired heat treating furnaces and machine tools located in this 60,000 sq. ft. zone. Concentrated loads from the furnaces are relieved by adequate hood and exhaust systems which impose a significant fresh air make-up load on the air conditioning system.

The system provides 1,861 gpm of 45°F chilled water to 17 air handling units located at various points throughout the factory and office zones. Air handling capacity of the units totals 250,000 cfm. Fresh air is brought directly into each unit and each system is arranged so that 100 percent fresh air can be circulated in spring and fall.

Air Distribution System

Conditioned air is distributed through sheet metal ducts located just above the lower member of the steel roof trusses. Since lighting fixtures and plant piping systems are generally located below this steelwork, very little interference was encountered with the duct installation. Air is discharged through conventional louvers located on collars at the sides of the ductwork. A typical duct installation is shown in Fig. 3. The system is designed to maintain 78°F dry bulb with a 50 percent relative humidity in the conditioned areas with an outside design condition of 95°F dry bulb and 78°F wet bulb.

The control system is pneumatic and is supplied with air from a compressor located in the refrigeration machine room. The control system provides for both heating and cooling and operates briefly as follows:

Winter Operation: A room thermostat sensing a rise in space temperature closes face dampers and opens by-pass dampers on the steam heating coil. As the face damper closes fully, the steam valve is closed on the heating coil. At this point, control air is supplied to a thermostat sensing the entering air temperature. If the entering air temperature is above 63°F, the thermostat starts closing the return air damper and opening the outside air damper as required to maintain entering air mixture at 63°F. At 70°F, the outside air damper is fully open and 100 percent outside air is being supplied to the space.

Cooling Operation: The outside air damper is fixed in the minimum open position and the return air damper is at maximum opening. A discharge air thermostat operates face and by-pass dampers to hold the discharge air at the desired temperature. A low limit thermostat prevents the discharge temperature

from falling below a preset minimum on either summer or winter operation. Should the entering air to the coils fall below 35°F, a manual reset "freeze-stat" shuts off the fan. Any time that the fan is shut off, the control system closes the outside air dampers and closes the coil face dampers.

A multizine unit is used at one location and control is similar to the above except that hot and cold deck dampers replace the face and by-pass dampers. Summer-winter changeover is manual on all control systems.

A system of condenser water temperature control is provided which operates the two cooling tower fans as needed to maintain condenser supply water at the desired temperature.

The increasing use of natural gas fueled internal combustion engines for driving refrigeration compressors is an interesting development in the air conditioning field. Smaller units driving reciprocating compressors have been in use for some years and have proved their reliability for this service.

Use Of Larger Engines New

The use of larger engines, particularly for driving centrifugal machines, is a relatively recent development. It is of particular interest to note the fuel economy of the large high compression engines which can produce one horsepower at the shaft for 6,000 to 9,000 Btu in natural gas. The inherent advantages of gas firing with no dilution of engine oil, no carbon formation, and no metallic deposits include low maintenance and long life with up to 30,000 hours before major overhaul.

The manufacturers of the engines concerned have existing service establishments over the country and are in a position to offer a wide range of service contract responsibility. As shown in the case of Black & Decker, a liberal charge-off for servicing and maintenance will still often leave an attractive saving for the user who decides to use the natural gas fueled engine drive for air conditioning compressors. ▲▲

CREDITS

Consulting engineers.....*The Austin Company*
Centrifugal refrigeration compressor .....*Worthington Corp.*
Gas engine, V-12, natural gas..*Waukesha Motor Co.*
Cooling tower.....*Lillie-Hoffman Cooling Towers*
Air handling equipment (single zone).....*The Trane Co.*
Air handling equipment (multi-zone).....*American-Standard, Industrial Div.*
Chilled and condenser water pumps .....*Worthington Corp.*
Pneumatic control system and equipment.....*Johnson Service Co.*
Unit heaters, natural gas.....*Modine Mfg. Co.*
Exhaust fans..*American-Standard, Industrial Div., and Jenn-Air Products Co., Inc.*

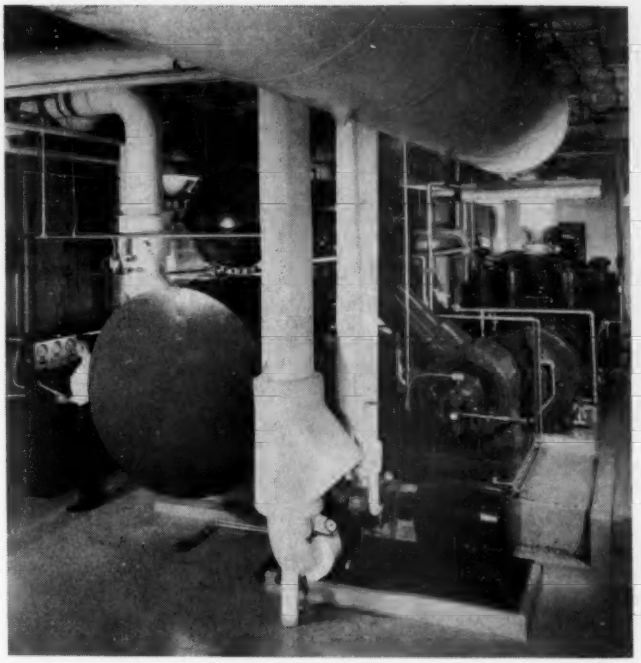
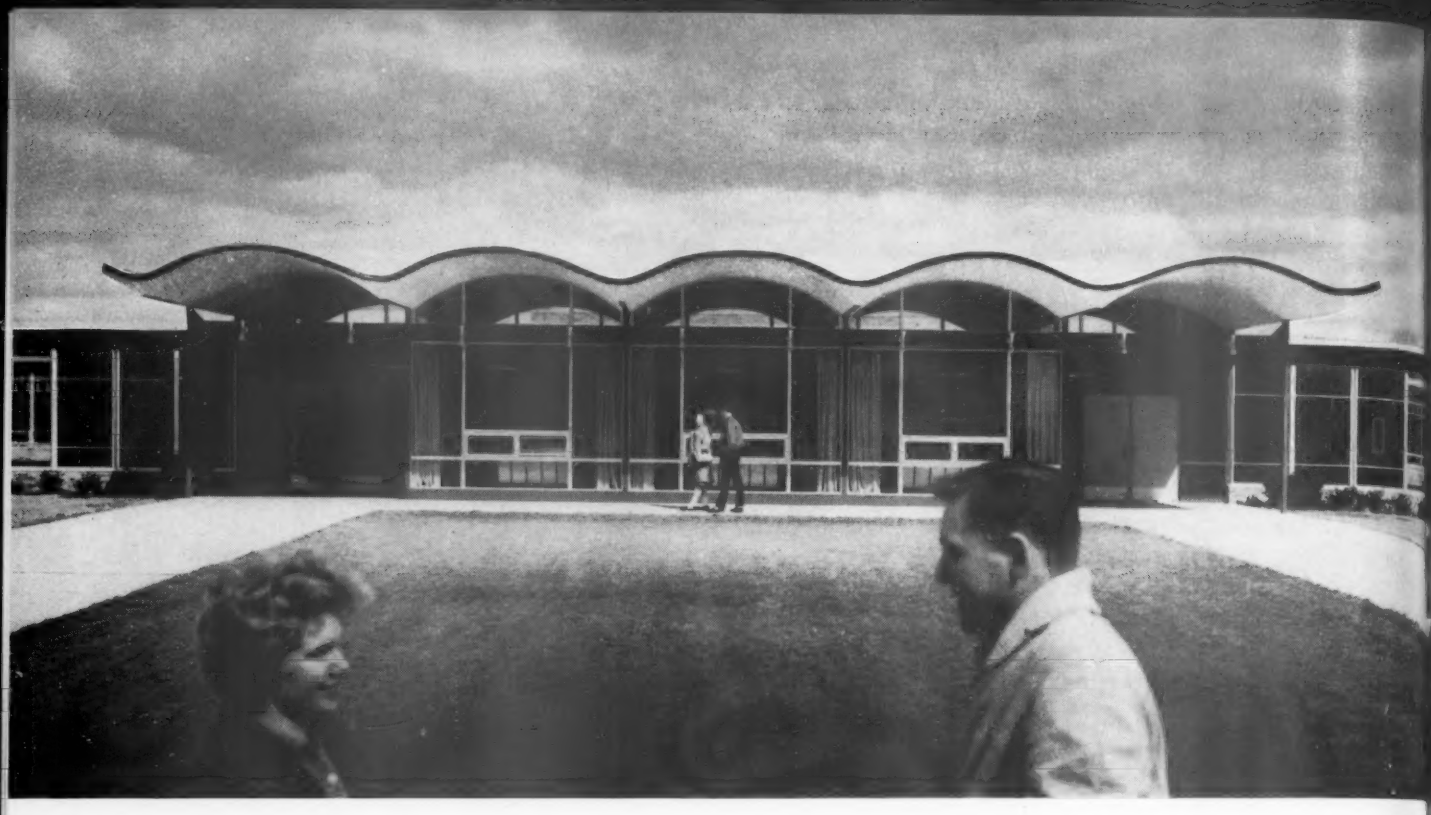


Fig. 3: Refrigeration machine room. Chilled water pump is in foreground and behind it are centrifugal compressor, gear speed increaser, natural gas engine, in that order. Muffler is shown at top of picture.

Fig. 4: Close-up of control consoles. Tank in background is refrigerant receiver and storage tank, with a small electric condensing unit mounted on top.



New Ways To Ventilate Electrically Heated Schools

Methods in this article point out how to reduce cost of electric heat through heat recovery, less ventilation air.

by James E. Benedict, P.E.
Consulting Engineer

ELECTRICAL HEATING, successfully used in residential and small office buildings for many years, has gradually crept northward into colder climates.

With the simple addition of more insulation, weather stripping on doors and windows and double glazing, electrical heating seems to be working out at or close to costs of other fuels in these buildings.

There is now a trend toward extending the application of resistance space heating to schoolrooms.

It must be realized, however, that there is a vast difference in the problems of properly heating a home, and heating a schoolroom.

For example, even in today's tightly built, weather-stripped, heavily insulated home, with from four to six occupants, natural infiltration plus the total of 8,000 or 12,000 cu. ft. of air space will suffice for diluting odors and keeping humidity below the dew point.

Schoolrooms are entirely another matter. First, 30 or more children are confined in a classroom space averaging 10,000 cu. ft. Second, heat gain from children and solar gain through windows means that the room will generally need cooling more often than it will need heating, even on cold days.

It is obvious then that even an electrically heated schoolroom needs ventilation beyond that provided by natural leakage for odor dilution and excess heat and moisture removal.

The problem in electrically heated schoolrooms is simply that ventilation is the most expensive part of the total cost, because it is not possible to insulate cold outside air brought in for ventilation.

The object of this article then is to examine ways and means of reducing the quantity of costly-to-temper outdoor ventilation air, in order to keep electrical heating costs more competitive with other methods of heating classrooms.

Odors, for example, can be removed by activated charcoal. The two leading manufacturers of activated charcoal claim that this

substance, installed in banks in the airstream, can remove all of the body odor from the air. Activated charcoal, according to one of the suppliers, if used to saturation, may take up to about 35 percent of its own weight of body odors. There have been many installations of this nature in buildings and they are quite successful in reducing the heating load and eliminating body odors. Therefore, if it is feasible to use activated charcoal filters for odor removal and dust filters for dust removal, and if we can remove moisture by refrigeration, we have accomplished our purpose.

Excess moisture (latent heat) from occupants' bodies can be wrung out of the air by properly designed, relatively small mechanical refrigeration systems, which would be little more than an oversize basement mechanical dehumidifier.

Reducing Ventilation Air

Here then is a proposed method of using chemical filters (charcoal) and mechanical dehumidification for reducing ventilation air volume in electrically heated schoolrooms. This plan is also applicable to other similar buildings with similar construction and occupancy, such as clinics, offices and stores.

Let's consider the use of an air-cooled mechanical refrigeration system to remove excess moisture (latent heat) from schoolroom air. The cooling coil in this system reduces temperature of air passing through it, thus squeezing out moisture from the air. The work performed in this moisture removal is now transferred by the refrigeration system in the form of heat to the air-cooled condenser, where this heat is normally wasted to atmosphere.

We take this heat and instead of wasting it to outdoors, use it to temper ventilation air.

Here are some figures to illustrate a typical application of chemical odor control, mechanical refrigeration moisture control and heat pick-up from this refrigeration system for heating ventilating air.

Average Classroom

Let us take an average classroom of 900 sq. ft., containing 30 pupils. With double glazing (thermopane) windows we can carry 38 percent relative humidity at -10° outside temperature. Thirty pupils give off 39,000 grains (5½ pounds or ⅔ gallon) of vapor per hour.

Assuming eight room air changes (with 10 ft. ceilings) we will have to chill 1200 cu. ft. of 72° room air at 38 percent relative humidity to 39°F. to remove the required amount of moisture. The amount of heat (sensible and latent) is 51,500 btu. This will require about six hp, or 3950 watts and will provide 13,800 btu (the heat of compression).

When the total of 51,500 btu plus 12,400 btu or 63,900 btu is returned to this air we will have 88°F. air at 17 percent relative humidity, with a sensible heat above room temperature of 20,750 btu per hour. This indicates: 20,750 btu minus 12,400 btu equals 8,350 btu we have additionally gained by condensing the vapor out of the air.

Room heating loss has been calculated at minus 10°F. at 20,000 btu from which we can deduct 4500 btu for heat gain from the pupils (sensible only) or an actual heat load during occupancy of 15,500 btuh.

Since we have 20,750 btuh to handle this load, we have 5,250 btuh at hand to use for other purposes, and we would actually be cooling this room at all times.

Since 88°F. air is of no value for cooling, it would be necessary to heat only one half of the air being circulated to 60°F. and heat the other half to 116°F., which can be used to heat areas which actually have a heat load due to low occupancy, such as toilets, corridors, etc. Please note that at this time we have in our calculations used none of the heat that is generated by lights or by the sun coming in the windows.

Heat Reuse

Having analyzed one classroom, which is the worst condition normally encountered in the elementary school, we should investigate the other room areas—offices, multi-purpose rooms, corridors, lobbies and toilet rooms.

Offices have considerably less humidity load than classrooms because of fewer people in larger spaces, so heat is needed here.

Multi-purpose rooms require less ventilation per sq. ft. than classrooms due to their higher ceilings,

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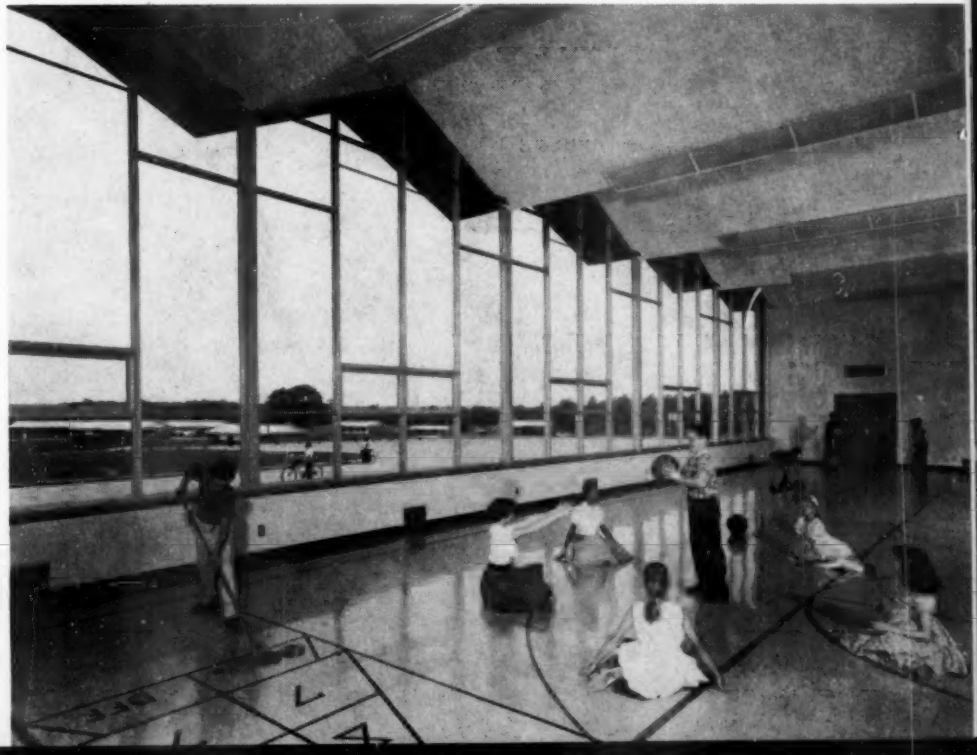
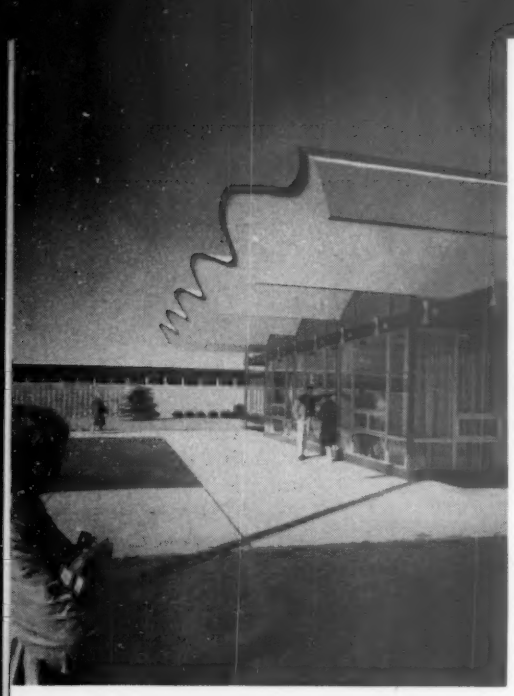


Right, this gymnasium, like other areas such as corridors, offices and libraries, can be heated partially with heat removed from highly populated classrooms.



Classroom Ventilation

(Continued from preceding page)

although if used for large gatherings they may approach the level of the classroom. These rooms therefore should be treated as a classroom for cooling, but also as a heated area for regular use.

Toilet rooms should be exhausted by ventilating fans, unless local codes can be waived, and resistance heating should be used for satisfying heat losses. This exhaust air must be replaced with outside air. A new technique now coming into use is to employ an activated charcoal recirculating unit within the toilet room and leave that room out of the general heating, cooling, or ventilating system. This may be contrary to codes in some places but it is recognized and being used elsewhere.

Corridors

Now we come to corridors and lobbies. It is here that most of the excess heat can be used.

In effect we have applied the principle of the heat pump, converting latent heat to sensible heat and removing sensible and latent excess heat from the classroom areas and using it in areas where it is needed.

It is obvious of course, when outside air is required by ventilation codes, this principle is still applicable for recovery of both sensible and latent heat for partially heating outside air.

This distribution and reuse of heat can be accomplished by a double duct system, with mixing dampers located at each room to deliver the proper amount of heated or cooled air, as required by the particular condition.

When we total the heat gains of lights and sun added to the building we may find that for many designs of buildings we may be able to achieve a balance in heat loss and heat gain at maximum load conditions. This is a problem that the consulting engineer, using the above principles, can solve for any type of school building.

Since we have only taken the maximum condition of minus 10°F. outside temperature, we should now look at the operation of this system at milder temperatures.

Outside Air

It is obvious that as soon as we reach a balance point requiring less than full heating capacity in our system we should start using outside air for cooling. As outdoor temperature rises, outdoor air can be used in increasing amounts to control indoor temperature by blending it with and thereby reducing temperature of air from the heat pump. Heated air from classrooms can be vented at this time. As outdoor temperature continues to rise, we now need less heat. Moisture removal (latent heat) can now be removed by venting it outdoors.

At the point where we no longer need heat and are operating only on outside air, we can rest for perhaps 5° to 10° of outside temperature change before we again start using the heat pump. The difference at this time, however is that we would use an air cooled condenser on the roof, or duct outside air through the heating condenser, and use the heat pump as an air conditioning unit, with a minimum of outside air, if any, going to the building.

With sunshades on the outside in the South and West exposures we should be able to do a good job of air conditioning the entire building for year around use.

The calculated heat gain of this typical South exposure classroom is 18,200 btu on August 1 at 2:00 P.M. Since six hp will give us about four tons or 48,000 btu per hour of air conditioning, we would be able to allocate the difference, or 29,800 btu toward cooling the balance of the building, which should prove adequate for an entire building of about ten classrooms

Night Heating

All of the above has been related to the hours of occupancy of the building. It is not desirable from an equipment life standpoint to run this equipment during the night hours, and therefore we propose to include sufficient resistance heating in the form of baseboard units to maintain night temperatures and to help increase the temperatures rapidly during morning "pickup." For certain areas, such as kindergartens, low density resistance heating cable in the concrete slab may be employed to insure warm floors.

It is the belief of the writer that this method of employing electricity for heating, ventilating and air conditioning a school building will offer the following advantages:

- **A more healthful environment.**
- **An atmosphere conducive to better education.**
- **Year around air conditioning.**
- **Ability to hold summer school effectively.**
- **Installation costs competitive with quality wet heat systems.**
- **Competitive fuel costs.**
- **Reduced labor costs.**
- **Utmost flexibility.**
- **Cleaner buildings.**

James Benedict is a registered professional engineer and president of Benedict and Associates, Detroit consulting engineering firm. Formerly project engineer with Giffels & Rossetti, he has had his own shop for the past six years.

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GUIDE TO . . .

Ventilation of Material Transfer

Practical data on ventilation requirements of transfer points where toxic materials are added to the chemical process stream.

By William V. Andresen
Chief Industrial Hygienist
American Cyanamid Co.

DRUMMED AND BAGGED SOLIDS are used as raw materials in chemical processing operations. When these solids are dumped into process equipment, dust is liberated. If the dust is toxic or irritating and is emitted in quantities sufficient to present an employee exposure problem, it may be necessary to provide some means of dust control.

Hood enclosure and mechanical ventilation may be utilized to provide this control. In a previous article describing ventilation for tanks, tubs and kettles (Aug., 1960, p. 34), several general designs of hoods to control the dumping of solids into the reaction vessel manhole were described. These hood designs can be adapted to accommodate transfer of material into other equipment such as storage bins, blenders etc.

When drummed material is dumped into conveying equipment such as a screw, belt or flight conveyor, a design which combines a hood enclosure and material hopper may be utilized. A typical design is shown in Fig. 1. In this particular design the hood opening is round, with a diameter slightly larger than the diameter of the drum to be dumped. This opening allows satisfactory control utilizing a minimum air volume. A velocity of 125 fpm across the open face of the hood enclosure will usually provide satisfactory control.

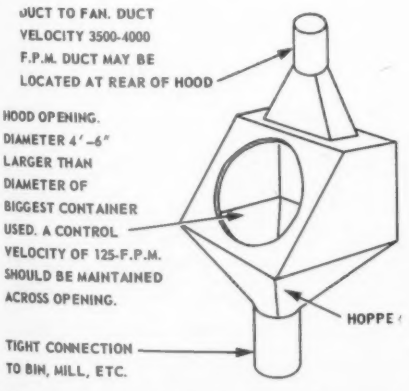
DUCT TO FAN. DUCT VELOCITY 3500-4000 F.P.M. DUCT MAY BE LOCATED AT REAR OF HOOD
HOOD OPENING. DIAMETER 4'-6" LARGER THAN DIAMETER OF BIGGEST CONTAINER USED. A CONTROL VELOCITY OF 125-F.P.M. SHOULD BE MAINTAINED ACROSS OPENING.
TIGHT CONNECTION TO BIN, MILL, ETC.
HOPPE

Fig. 1: Hood to control dust liberated during dumping of drummed solids. Remove drum cover when top is in opening.

Some drummed solid materials are irritating or toxic in extremely small amounts, either due to the airborne dust, or to vapor if the material vaporizes easily. To insure a minimum chance of exposure the hood enclosure should be designed so that the opening and closing of the drums may be accomplished under influence of the control air volume. For larger containers such as 55 gallon drums this may be accomplished in a hood as shown in Fig. 1. This requires lowering the closed drum into the hood opening before removing the cover and covering the emptied drum before removing it from the hood.

For smaller drums, the hood may be designed large enough to accommodate the entire drum. The drum is then opened within the hood, emptied and the empty drum closed within the hood enclosure. It is possible to leave the drum within the hood if necessary to allow volatilization of solid spilled upon the drum during dumping operations. If necessary, the drum may be cleaned or washed within the hood enclosure before removal. Fig. 2 shows a hood enclosure in which this procedure may be followed. A control velocity of approximately 125 fpm will usually provide the required control.

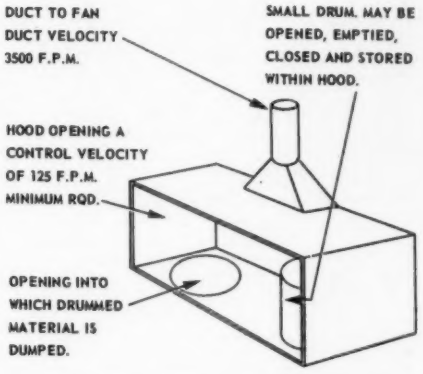
DUCT TO FAN DUCT VELOCITY 3500 F.P.M.
SMALL DRUM MAY BE OPENED, EMPTIED, CLOSED AND STORED WITHIN HOOD.
HOOD OPENING A CONTROL VELOCITY OF 125 F.P.M. MINIMUM REQ.
OPENING INTO WHICH DRUMMED MATERIAL IS DUMPED.

Fig. 2: Hood enclosure for dumping small drums of extremely toxic or irritating material.

In batch processing (grinding, screening, etc.) of dry material, it is often necessary to feed the material intermittently to the process equipment to prevent blockage or to control a reaction. The common practice is a scooping or shovelling operation directly from a drum into the equipment. If the material is toxic or irritating, however, control of the operation is desirable.

Control of the dust may be realized by the provision of a hood

(Please turn to page 41)

***WILLIAM ANDRESEN** is chief industrial hygienist for the American Cyanamid Co. A graduate engineer, he is vice chairman of the Bergen County, New Jersey air pollution control committee. He is also a delegate from the National Safety Council to the American Standards Association committee Z-9 on industrial ventilation. He is a member of the American Industrial Hygiene Association.*

Fig. 1: Granulating room, where chemical powders are mixed and blended, has temperature controlled to 70° and humidity to below 20 grains of moisture per pound of air. Machine shown is a 20 cu. ft. twin shell blender.

by Joseph Rosenthal, P.E.,
President, and
Gerald Ludwig, P.E., *Dep't Head*
Engineers Inc.

In an automated pill plant . . .

Engineered Air Boosts Comfort, Speeds Processes

Tracing production of pill in its various stages, article describes complicated temperature-humidity control system at each step. An explosion-proof room, dust control, air curtains over pans, constant climate rooms, are detailed by the authors.

IN 1955, WHEN Engineers Incorporated, Newark, N. J., received a special award for excellence for the design of a 40,000 sq. ft. industrial building, we could not perceive how seriously our talents would be tested five years later when we were invited to convert the same installation into one of the most advanced, flexible centers for pharmaceutical technology in the country.

Strong Cobb Arner Inc., one of the largest and most diversified custom manufacturers of drug products in the United States, acquired the modern facility in 1958 and began the development of its plans for doubling pharmaceutical production. The plant, located in Murray Hill, N. J., is to our knowledge a combination of one of the most complex ventilating, air conditioning, dust prevention, air handling and dehumidification control conditions ever attempted in an industrial remodelling.

The half million dollar remodelling operation was a challenge to our engineering ingenuity in that each of the important steps in tablet manufacturing required an almost completely different set of humidity, ventilating and air conditioning standards. And the design had to be integrated with the manufacturing procedure in that it would not hamper the automated, high-speed processes that account for a production volume of between one-quarter and one-half million finished pharmaceutical and toiletry packages alone per day.

Initially, the plans called for an addition of 30,000 sq. ft. that would be used as a warehouse. The original 41,500 sq. ft. plant was to be converted from a warehouse-liquid-packaging facility into a high-speed pharmaceutical production center. This not only included the design of the facility to be erected, but the layout of the production process as well.

The biggest single problem which confronted us as designers was how to create the unusual conditions of temperature and humidity economically while staying within the stringent requirements of our client. Therefore, rather than discuss complexity of the problems and the varying conditions in an analysis of the entire project, we will trace instead the steps involved in the production of a common cold tablet and the air engineering problems as they apply in each stage of its development.

Bulk powders arrive at the pharmacy from the newly constructed warehouse addition where they are weighed out, put on skids and hauled away for the start of the manufacturing process. Since nothing has been done to the chemicals and dyes other than weighing-in in this first stage of their development, the huge pharmacy is air handled exclusively by the existing plant comfort conditioning system, without the need for special ventilation or dehumidification control.

Granulating Room

Arriving at Granulating Room No. 1, the powders are immediately subjected to air conditioning at a constant 70°F and humidity controlled atmospheres during mixing and blending operations. Relative humidity in the room is reduceable to well below 20 grains of moisture per pound of air, or approximately the 19 percent which is required in the handling of effervescent products where moisture would cause the product to break down. The room, one of many vapor resistant areas, is sealed off by a special type of rubber gasketed doors and is attractively decorated, including walls, ceilings and floors, with a sealer paint as further insurance against ground moisture or dampness seeping in.

Although it might have been possible to use a standard commercial three-ton package for the 30 ft. x 26 ft. room, it was decided to use a special built up unit which is a combination of refrigeration and dehumidification equipment employing a liquid type of desiccant. The refrigeration unit included a water cooled condensing unit. The special package provides for both units to operate together by controls, but they are operated generally independently of each other despite the fact that they use the same ductwork. The result of using the special unit proved extremely successful in that the user has reported neither temperature nor humidity fluctuations of more than ±1 percent.

In Granulating Room No. 2 (Fig. 1), the air

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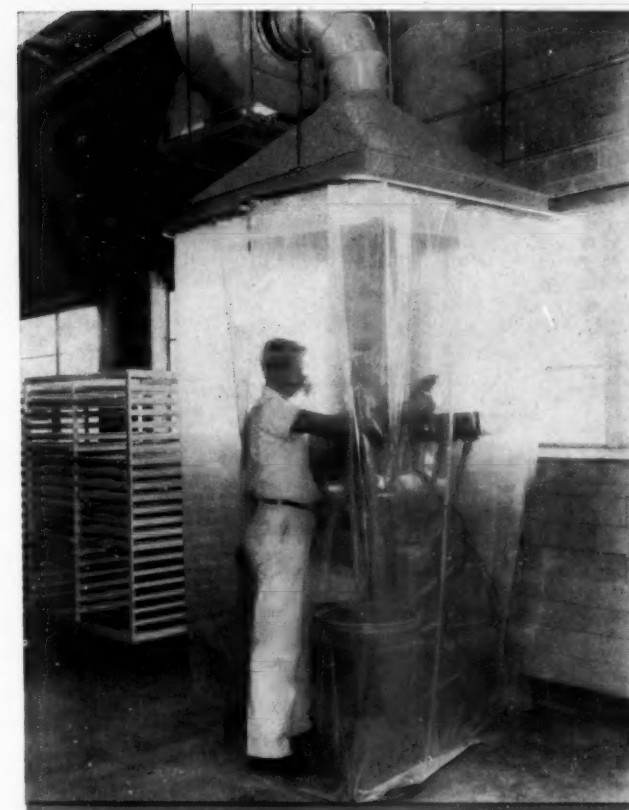
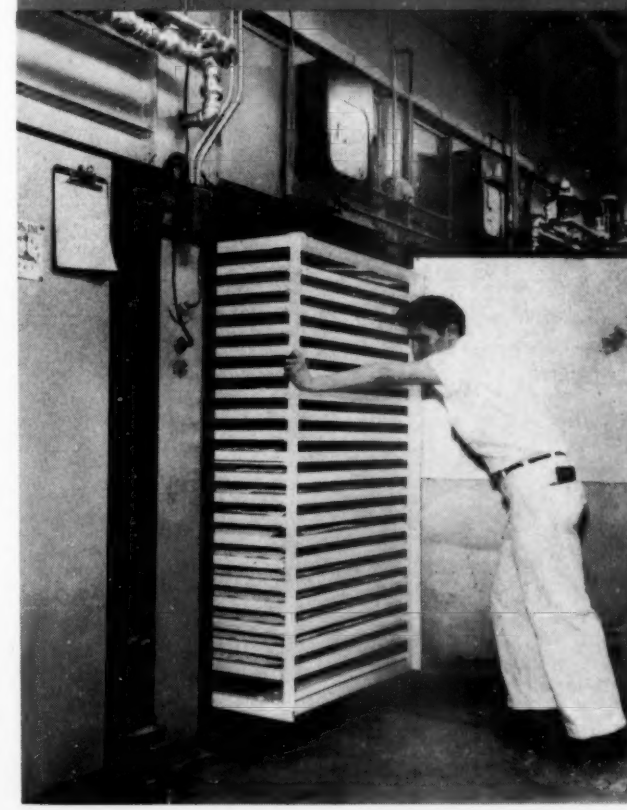


Fig. 2: Mobile mixing machines are rolled under plastic curtained exhaust intake to remove irritating chemical dusts and dyes, keep them from contaminating or reacting with other chemicals.

Fig. 3: Trays of mixed powders are rolled into dryers. Fans furnish make-up air to corridors when dryers are located to keep dryer air from conditioned rooms.



Air Engineering For Pills

(Continued from preceding page)

handling problems begin to take shape. In order to prepare the chemicals in a sand-like mixture prior to sending them to the Compression or Tabletting room, they must be mixed in a variety of portable machines that emit clouds of irritating dust which must be exhausted immediately. The portable mixing and granulating machines are rolled under a huge air intake surrounded by a plastic shower curtain (Fig. 2) that confines the dust to the immediate area of the exhaust. Room air is replenished from the in plant makeup area thus ensuring the desired humidity and temperature conditions. The room is not air conditioned in that it is not required during the mixing operations.

The mixed and granulated powders are then set out in trays (Fig. 3), placed in mobile racks and rolled into large industrial ovens or dryers where their moisture content is reduced prior to being sent to the Compression Room. While the sand-like mixtures of chemicals are drying in the near dozen commercial ovens, no problem of dehumidification or high temperature exists. However, once they have completed their cycle of 12 to 48 hours at 120, 140 or even 200°F, and the doors are opened to remove the racks of trays, a temperature and humidity problem become apparent.

To minimize the problem, in the original design of the manufacturing process, the layout called for location of dryers in the corridor between the separately temperature controlled rooms. Thus, no sooner is hot dry air admitted into the corridor (which if not removed would find its way into the air conditioned rooms) than it is exhausted directly from the corridor and independently from the other ventilating systems before it can create a problem.

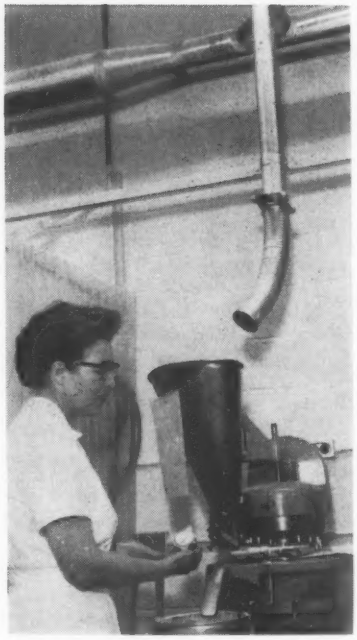


Fig. 4: Compression room tablet-making machines are serviced individually by ceiling - suspended air exhaust system. Fiberglas partitions isolate machines so different types of pharmaceuticals can be manufactured simultaneously.

The granulated, mixed and dried powders are then taken to the Tabletting or Compression Room which combines all three of the necessary conditions of low relative humidity – 30 to 40 percent – air conditioning – maintained at 70°F – and dust removal exhaust system that sends the dust-laden air to the roof of the building, cleans it and recirculates it to the Compression Room so that all the factors remain constant.

The tablet compressing or slugging machines are individually serviced by an exhaust intake and are separated by fibreglas dividers, an innovation which assures protective isolation of the separate products, all of which could logically be undergoing manufacturing simultaneously. Space limitations being critical in the Compression Room called for a design that

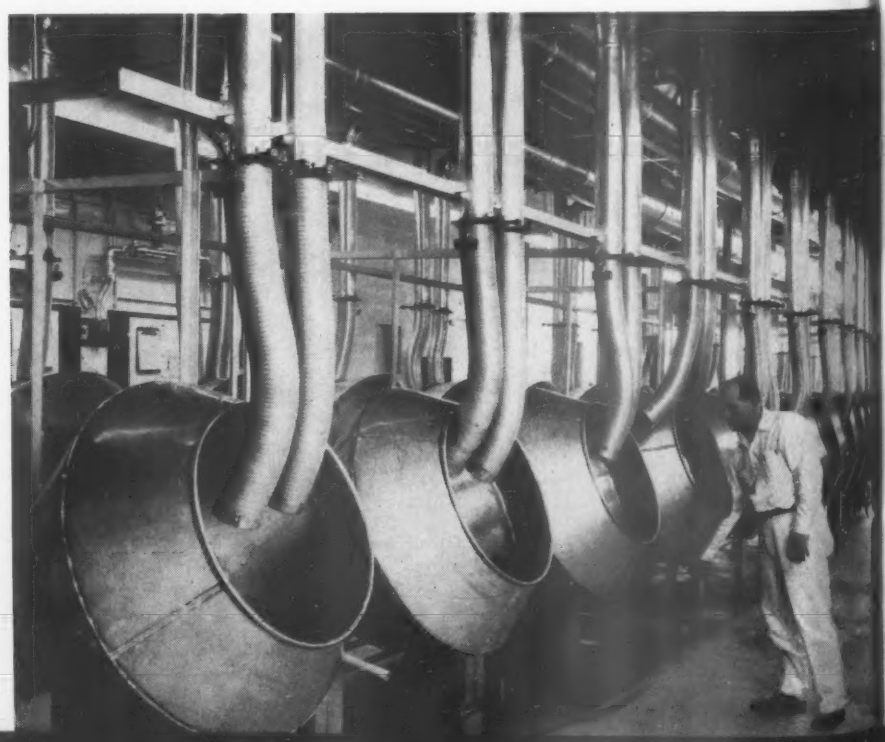


Fig. 5: Right, coating pans are fed by intake and exhaust tubes. To be installed is a slotted duct to blow curtain of high velocity air over mouth of pans to keep out room air.

provided for the suspension of the air handling system, including reheat coils, compressors, filters and recirculation system, from the ceiling of the room.

Within the Compression Room are two specially designed Isolation Compression Rooms used in the production of pharmaceuticals, cosmetics or toiletries which would normally contaminate or cause problems with other compounds because of the colors of the dyes, odors or chemical reactions. Each of the isolation rooms are tied in individually to the same overhead air handling system, as shown in Fig. 4.

In the Compression Room, which achieves the same degree of variation in temperature and relative humidity as the Granulating Room, we chose to use a 25-ton modular, mechanical refrigeration and dehumidification unit for the 35 ft. x 31 ft. room which was also designed to handle the extra load of the two isolation rooms.

The special feature of the equipment in the Compression Room is the exhaust system which must prevent dust from accumulating in the room while at the same time saving the exhausted, cooled air and returning it to the room. Upon exhausting the cooled, dust-laden air, the system then passes it through an oil bath filter before reusing it as return air. This technique provides a considerable savings in air conditioning tonnage required to maintain the room under the given conditions.

Coating Room

Perhaps the most unique of the innovations in the air handling system is the Coating Room where the tablets are placed in a bank of 32 back-to-back revolving coating pans (Fig. 5). In this unair-conditioned room, hot dry air is blown into the pans at 110°F with an unusual moisture content requirement of 50 grains of moisture per pound or about 15 percent relative humidity.

From the 6,000 cfm, chemical type desiccant dehumidification unit, hot dry air is supplied to the mouth of the revolving pans. A separate exhaust for moisture-laden air is also located at the mouth of the pans which exhausts 50 percent more air than is supplied in order to protect against the dust-laden air getting out into the room. The feat is accomplished simply with the use of dual nozzles, on supply and exhaust. One supplies 200 cfm of hot dry air to the pan while the other extracts 300 cfm.

Having solved the problem of keeping the moisture-laden air from filtering into the room, it was then necessary to prevent the room air from being pulled into the revolving coating pans. To prevent this, a small amount of forced air is shot at high velocity across the mouth of the pans in order to create a curtain of air that prevents the room air from entering the pans.

Finally, in order to prevent the more powerful exhausts located at each pan from creating a negative pressure in the room, make up air is supplied to the Coating Room in the amounts that are desired. When the exhaust system is started, fans in the hall outside of the Coating Room (Fig. 6) are energized and supply the needed make up air.

(Please turn to following page)

Fig. 6: Part of mechanical equipment shown above includes air conditioner, cooling tower and gas heaters. This equipment services coating room only.

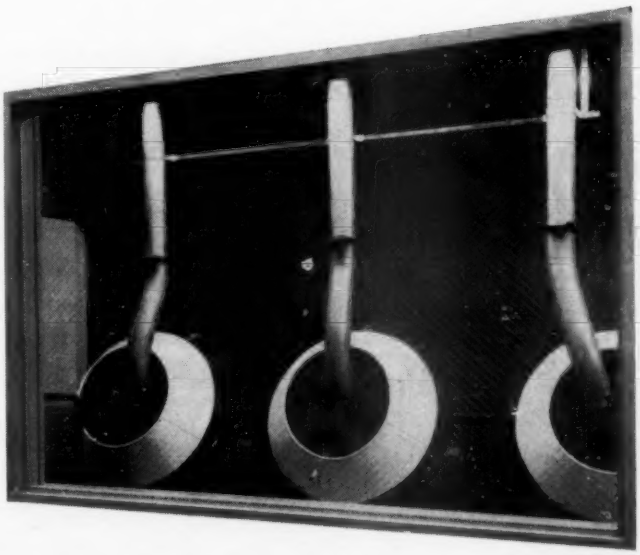


Fig. 7: Explosion-proof polishing room is isolated by partitions from rest of plant, because of inflammability of solvents used in polishing.

Air Engineering For Pills

(Continued from preceding page)

Because of the heavy concentration of organic dust in the exhaust air from the Coating pans, it was decided not to exhaust it directly into the atmosphere but to pass it through a dust collector instead where the dust is wetted and washed down and the organic matter precipitated into a sewer. The cleansed air is then disbursed into the atmosphere.

The design of the Polishing Room (Fig. 7) was based on the fact that there are odorous solvents used in the polishing. Air conditioned and humidity controlled to 30 percent, the special exhaust system takes the exhausted air through an activated carbon air filtration system and returns the cleaned air to the Polishing Room for reuse. The 34 ft. x 25 ft. room is handled by a 10-ton air conditioning unit.

From the Polishing Room the tablets are taken into the vapor resistant Branding and Inspection Rooms and finally into the air conditioned, vapor resistant Tablet Stores Room – 70°F, 30 percent RH – where they are stored until they are sent to the Packaging Room and then from there to the warehouse for shipment. Both the Tablet Stores Room and the Branding and Inspection Room are supplied by a 10-ton air conditioning unit.

To accomplish the air handling problems imposed by the Coating Room, a special 50 ft. x 16 ft. equipment room was constructed outside of the Coating Room and abutting the exterior wall of the building. It houses all of the air conditioning equipment, cooling towers, water dust removal exhaust system and gas heaters. Such extra construction was necessary because of internal space limitations and because an engineering study revealed that one large unit could not handle to the best advantage all of the various zone control requirements the nature of the manufacturing demands.

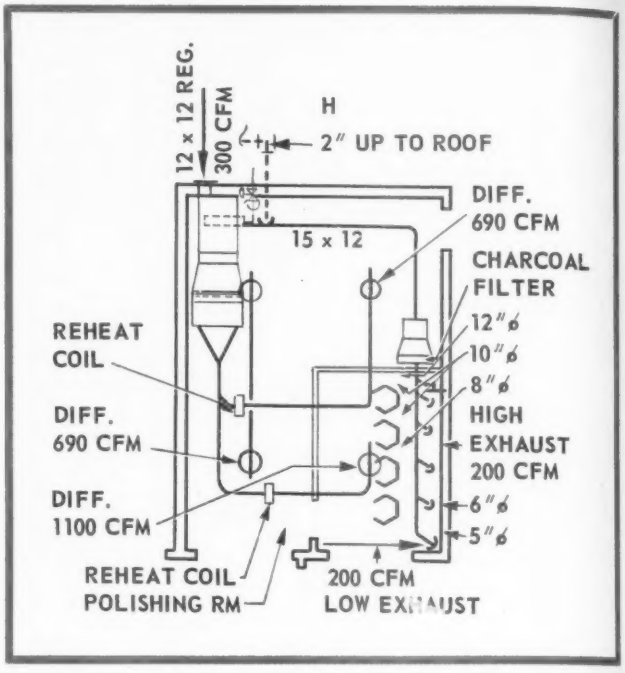


Fig. 8: Layout of part of equipment in polishing room.

The 100-ton plant air conditioning unit that serves the Packaging Room, the Liquid Compound Area, the Quality Control Laboratory and the general administrative offices, was used in as many applications in the new construction as was feasible. By tying in directly with the existing refrigeration and condensing plant, a considerable savings, that could have been spent in duplicate construction, was achieved.

The 100-ton plant system is supplied with water from a natural well located on the property. The constant 52°F temperature water is used both for

(Please turn to page 40)

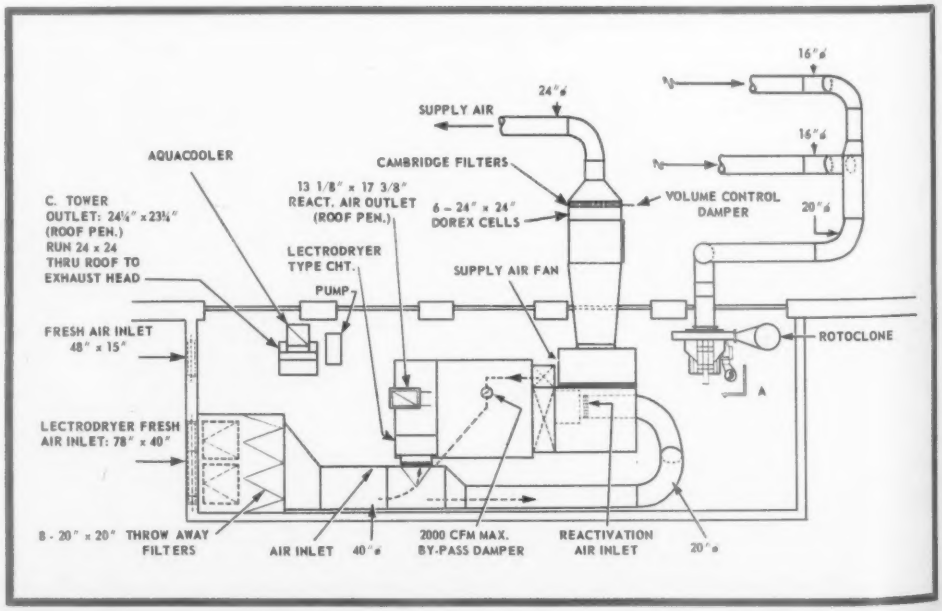


Fig. 9: Air conditioning and industrial ventilation of temperature and humidity controlled spaces, typical plan, in coating room.

Rework rate cut from 1200% to 20% by . . .

Super-Clean White Rooms

Part II

High reliability of super-miniaturized products in the missile and many civilian industries requires dust-free environments for their production, such as those described in this article about Autonetic's super-clean room facilities.

by W. R. Jerome
Group Leader, Producibility Study Group
Autonetics Division
North American Aviation Co.

LAST MONTH Mr. Jerome described how the dust-free facilities at Autonetics are laid out. In this last of a two-part series he discusses dust measurement, the human equation and an ideal "white room."

There is direct correlation between dust count and personnel activity in an area.

Normally on Monday morning our dust count stays low for a while. After a three-day week-end you might expect this to be especially true. However, after the last Labor Day week-end, our dust count soared. We checked the rooms, the entrances, the filtering system, the man-cleaners, and the smocks; everything seemed in order. For two days we were on the verge of shutting the room down. Meanwhile, however, we were having the dust particles analyzed.

Results? Skin particles. Many of the workers had gone to the beaches over the long week-end and had had too much sun. Consequently, they were sunburned and pealing.

How do you lick this one? Face masks? I don't know!

Consider the morning and afternoon coffee breaks, which are union mandatory. There are a minimum of four entrances and four exits for each assigned worker in the area: in the morning, in and out for the mid-morning coffee break, in and out for lunch, in and out for the afternoon coffee break, and out at night. Besides these, there are the unscheduled trips of the assigned personnel, as well as those of the visiting personnel, supervision, engineers, etc.

To control this constant personnel problem and to attempt to encompass its many aspects, Autonetics has instigated a set of procedures.

All personnel assigned to a dust-controlled area go through a three week Dust Controlled Room training program. This program is used to introduce the

(Please turn to following page)

Fig. 1: Back view of utility benches in the assembly area. Benches are aligned end-to-end across the room, with utilities piped in under the bench so that the layout is semi-permanent. The electrical wire can be broken at the end of any bench, as can the vacuum, nitrogen, helium, and hydrogen lines.

White Rooms

(Continued from preceding page)

trainee to the confinement and restrictions involved with the dust-free procedure, while also developing his personal habits which are required to maintain cleanliness in his area. The program is presented in a *simulated* dust-controlled (Class B) area, utilizing all of the requirements which are necessary to maintain cleanliness and a low dust count. Ideally, everyone concerned with a dust-controlled area should take this course – inspection personnel, production control, liaison, supervision, engineers, even the janitors and maintenance people should take it.

Six years ago when I was showing a supplier through our recently completed first good dust-controlled room, we were watching a janitor wipe off a ledge with what appeared to be a piece of torn rag. I assured the visitor that it was a "dust-free" linen napkin. At the end of the wiping he casually shook the rag out in the air. I almost passed out! Pieces of lint went flying in all directions – it was just a piece of torn rag. Needless to say, we've tightened up a lot on our janitorial service since that time. We are now using polyurethane sponges, tac-rags, and chamois skin-type mops. But it does take a good strong training program and a good strong supervisor to assure that people in a dust-controlled area behave and work as they should.

A list of special regulations has been prepared; all dust-controlled room personnel are familiarized with it and expected to adhere to it.

Constant Dust Counts Taken

One of the most effective methods of ensuring that a dust-controlled area stays within specifications is by taking constant dust counts (Fig. 2). Autonetics went to its present system of dust counting about a year and a half ago after twelve months of research into many different methods and techniques. The old system used a microscope type dust counter – fast but not too accurate. As the dust count is one of the major safeguards of a dust-controlled area, I am going to summarize and briefly outline the procedure we now follow in collecting and analyzing particle contamination in air. We consider dust count so important that we are currently using eight girls full-time plus back-up personnel to continually take dust counts in our 17 dust controlled rooms and numerous cabinets.

The equipment used for dust counts consists of clean Millipore filters of .45 micron pore size, a vacuum pump and cfm gage, a 430 power microscope, and some miscellaneous equipment.

The operation must be performed in a controlled room. The first step is to count the dust particles on a clean filter, then install the clean filter in the vacuum line of the vacuum pump. Ten cubic feet of air is drawn through the filter at bench level. The

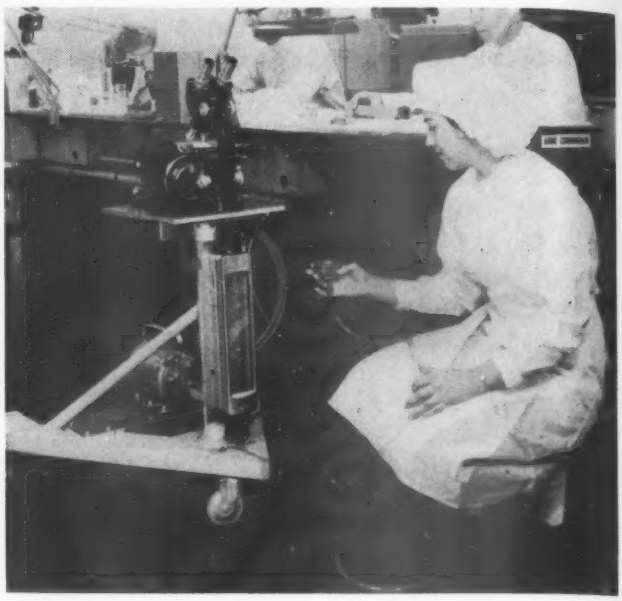


Fig. 2: Technician taking dust counts as shown above is an effective method of keeping dust within specs. Eight technicians are employed on full time basis to take these counts.

filter is removed and the dust particles recounted. If all the particles are counted, merely subtract the first count from the second count and divide the result by 10 and this will yield the particles per cubic foot. Autonetics makes this count as follows.

We first mark the filter in four places, 90° apart, and read one microscope width across (Fig. 3). The disc is rotated 90° and read a second time. Then the same two paths are read after the air sample is taken.

We have calculated that with the 100 power microscope we read 1/9 of the exposed filter area and, with the 430 power scope, 1/40 of the exposed filter area. Particles are sized in six groups: 5-10 microns, 10-20, 20-30, 30-50, 50-65, and 65+. Approximately 50 percent of the total count is in the smallest group, 30 percent in the next group, and 5 percent of the total count in each of the other groups. If any one group is unusually large, we start looking for the cause.

Dust concentration and particle size should be measured several times a day in each dust-controlled room and charted or made with a continuous dust-recording instrument. Explanations for any extremes should be noted.

A typical chart is shown in Fig. 4A. If the total count on the chart is over the allowed maximum, we exert an all-out effort to reduce it to specified tolerances. If we can't immediately get the count in tolerance, we cease assembly operations and evacuate the room until clean-up operations are completed.

One of the advantages of this type of dust counting is that a continuous analysis is made of dust particles so that if something new shows up it can be eliminated at its source.

The main factors which we are unable to measure, and which limit the reliability of a room to stay within specification, are the amounts of dust particles carried into the dust-controlled area by personnel, and the amount removed by cleaning procedures.

Dust-control methods are not limited to either preentry into the dust-controlled room or to constant dust counts. In spite of all of our precautions, dust, even in minute quantities, is still present within the dust controlled rooms. To keep this level within specifications, certain regulations have been established.

There are no dust-generating operations within the dust-controlled area, such as grinding, filing, dry polishing, or belt-driven motors. All of the parts-washing rooms attached to the dust controlled area have hooded exhaust vents and washing solvents which are double-distilled.

There are no pressure air hoses in the area; only vacuum equipment which is standard and commercially available.

The complete dust-controlled room, including tools, drawers, walls, ceiling, floors, lights, pipes, undersides of bench and stools as well as the inside of the air ducts, are cleaned on a regular schedule.

All equipment, such as benches, cabinets, trays and containers, and chairs, are constructed of a hard, smooth-finished non-fibrous material. Tools, jigs, pictures, and test equipment are specially designed for ease of cleaning and for prevention of contamination, such as elimination of sharp corners, hidden sections and knurled knobs.

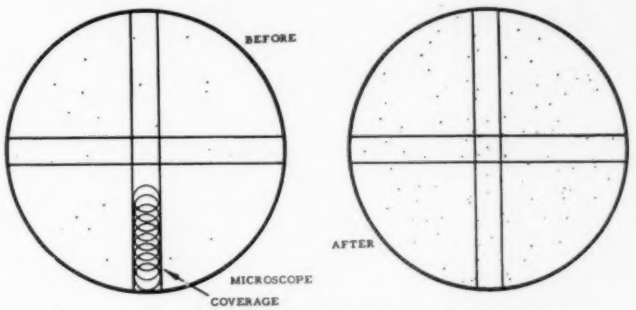


Fig. 3: MILLIPORE FILTER BEFORE & AFTER DUST COUNT

Plastic or glass covers are used to cover all parts not currently being worked on. When an operator lays a part down, he must cover it.

The dust-controlled rooms are evacuated for a major maintenance repair job, then thoroughly cleaned, with the dust count down to normal prior to starting regular work again. However, minor maintenance may be performed with only that particular portion of the room evacuated, as the blanket of air in the room tends to isolate the dust to the area in which it is being generated. Vacuum air is exhausted to the outside via a dust collector.

Each dust-free room has temperature and humidity recording equipment permanently installed.

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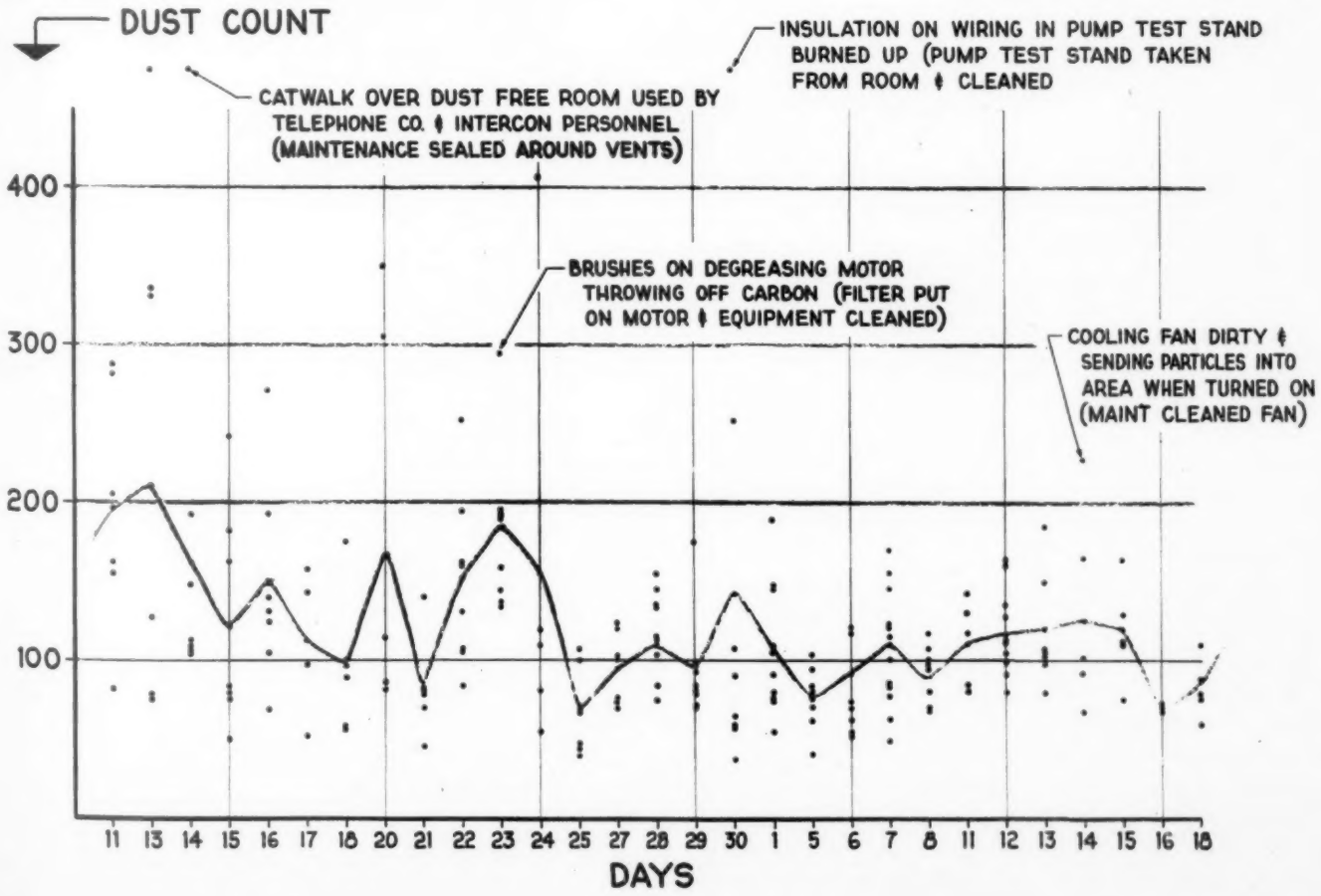
Fig. 4A: Below, chart of dust concentration and particle size specification at Autonetics.


DUST COUNT
INSULATION ON WIRING IN PUMP TEST STAND BURNED UP (PUMP TEST STAND TAKEN FROM ROOM & CLEANED
CATWALK OVER DUST FREE ROOM USED BY TELEPHONE CO. & INTERCON PERSONNEL (MAINTENANCE SEALED AROUND VENTS)
BRUSHES ON DEGREASING MOTOR THROWING OFF CARBON (FILTER PUT ON MOTOR & EQUIPMENT CLEANED)
COOLING FAN DIRTY & SENDING PARTICLES INTO AREA WHEN TURNED ON (MAINT CLEANED FAN)
400
300
200
100
11 13 14 15 16 17 18 20 21 22 23 24 25 27 28 29 30 1 5 6 7 8 11 12 13 14 15 16 18
DAYS

White Rooms

(Continued from preceding page)

We at Autonetics are convinced that the original cost of constructing the dust-controlled areas has been more than justified by the results obtained. The incorporation of dust-controlled areas into our manufacturing processes has statistically paid off in time saved, cost reductions, and, finally, component and system reliability.

Gyroscopes, one of our minor product lines, were previously one of our major problems. One of our early gyros, the G-2, averaged, for every 10 gyros built, 120 reworks before passing inspection. That's an average of 12 reworks per gyro. Upon construction of the dust-controlled area, for every 10 gyros built, only 2 were subject to rework. A total reduction of the rework rate from 1200 percent to 20 percent.

The type of meticulous assembly which is permitted by the dust-controlled area results not only in this initial lower rework rate, but in higher component reliability and thusly, higher system reliability.

Autonetics has attempted to make its name synonymous with reliability. From the lamentable statistics of the military electronic equipment used in the Korean War . . . over one million replacement parts for only 160,000 units of equipment . . . radar equipment inoperative 84 percent of the time . . . sonar equipment 48 percent of the time . . . Autonetics has, in less than a decade, reduced the inoperative time of its electronic and electro-mechanical equipment to a negligible factor. Our MG-4 fire control system has achieved a 92 percent reliability rate in overseas operation . . . Autonetics NADAR's, the airborne data recorders, have a 98 percent in-flight reliability factor . . . over 140,000 hours of operation have been logged by Autonetics gyros while maintaining specified high performance.

This type of high reliability is, of course, due to many contributing factors, one of which is Autonetics top-grade manufacturing and inspection personnel. However, Autonetics has an average 30 percent fewer inspection personnel than comparable military electronics firms. And part of the reason for increased reliability and less inspection personnel are the dust-controlled areas used for the initial fabrication and inspection of precision assemblies and components.

Conclusions

Industry's trend today is towards miniaturization and sub-miniaturization. This means even finer tolerances and clearances, either one of which requires greater care in fabrication. Functional performance and reliability of a precision assembly is directly proportional to its cleanliness.

Dust-controlled areas are vital to precise electro-mechanical manufacturing operations. Unfortunately such areas cannot be obtained or maintained without considerable expense and continuing effort by all directly concerned in white room operation.

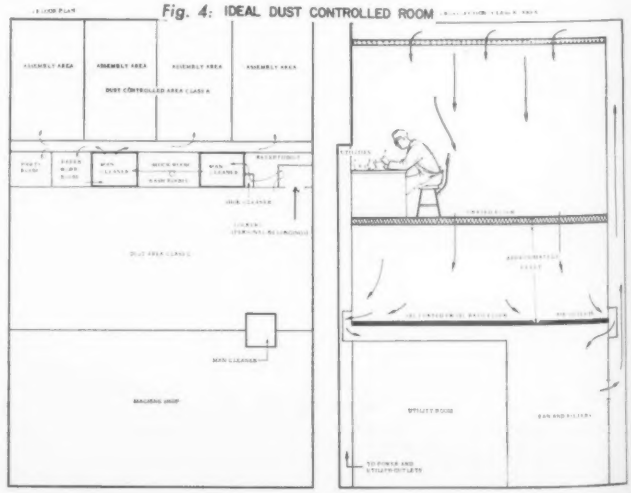
Autonetics, by now firmly convinced of the necessity of dust-controlled rooms, is just as concerned as any other manufacturer with future increased usage and the accompanying costs of these areas. Present plans call for an additional 45,000 sq. ft. of dust controlled area in the near future, and constant research is being carried out to obtain an optimum dust controlled area with a minimum expenditure.

One type of ideal dust-controlled room which is being considered is shown in Fig. 4. It's a dust-controlled room where a man would have to walk across a grated floor and through a man cleaner, remain inside for at least 30 seconds, before he even comes to a receptionist area, before he can pass a part into the cleaning area, or a paper into the paper work area, or before he can receive anything from the controlled room. If he is to enter the inner dust-controlled room, he would have to leave his coat and personal belongings outside, get his shoes cleaned in a shoe cleaner and go through a second man cleaner for 30 seconds, then proceed to the smock room for a smock and hat.

Man Cleaner In Ideal Room

Wash rooms would also be in this area. He would then go through a third man cleaner for 30 seconds before finally stepping into a hallway. From this hallway, doors lead in to 1,000 sq. ft. assembly areas. These areas would be three stories deep, with the top story being a normal Class A dust-controlled room, except for the floor. The floor would be a grounded grating of approximately one inch square openings, so that the blanket of air from the multi-louvered ceiling, moving gently downward, would go right through the floor into the room below and would be exhausted around the periphery of the middle room, one to five feet below the grated floor. The middle room has an oil covered floor which catches all dust particles coming in contact with it. The oil may be as thin as a coat of paint or as thick as two inches with a pumped and filtered recirculating system. The only purpose of this middle room is to assist the dust

Fig. 4: IDEAL DUST CONTROLLED ROOM



and dirt generated in the working area to stay below the bench tops.

Any possible roiling of dust caused by the air striking a solid floor would be eliminated. These two rooms must, of course, be completely sealed off per normal dust-controlled room practice. The basement or bottom room contains all the utilities and utility connections which are in turn fed up through the walls to the benches and outlets in the dust-controlled room working area.

White Room In A Cabinet

As parts are getting smaller as we go into subminiaturization, with its accompanying finer tolerances, Autonetics has determined that this work can only be done in a Class "A" area. As a Class "A" area can only be found in an enclosed cabinet, there is a possibility that a well-designed cabinet might eventually eliminate the need for the surrounding Class "B" room, thus eliminating the dust-controlled room and its personnel and maintenance problems. This cabinet would have the advantage of being completely portable, both within-plant and in the field. The enclosure would contain a practically 100 percent dust-free, inert gas controlled environment.

Either one of these concepts – the ideal dust controlled room, or the Class "A" cabinet – would result in a super-clean facility, a facility which today is a hope, *but tomorrow must be a reality!*

In closing, I will leave you with these simple admonitions: Build your rooms simply and keep the room sizes to a minimum. Plan the room layout to reduce traffic. Indoctrinate your personnel thoroughly and enforce the personnel regulations. Have strict entrance requirements. Use the best man-cleaners and best garments available. Keep as much equipment outside of the dust-controlled area as possible.

Autonetics now performs all of its precision assembly and maintenance in dust-controlled areas. In this way we are keeping abreast of the current electronic and electro-mechanical advances, and keeping our name synonymous with reliability. For without reliability, the finest electro-mechanical devices in the world is of no more use . . . than a particle of dust. ▲▲

Use Communications Center, page 51, for requesting more information about advertised products, new literature, or new products.

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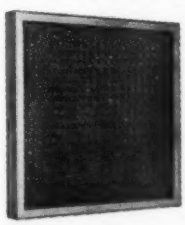

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[For more information circle #27 on page 51]

Air Engineering For Pills

(Continued from page 34)

the comfort conditioning system for the remainder of the plant as well as the special applications required in the different steps in the manufacturing process.

Lay-Out Problems

In addition to all of the other special problems, all air conditioned rooms were layed out next to each other, which required expert juggling in the flow of manufacturing procedure in order to accomplish it. In almost all cases air handling equipment, including compressors and the like, were suspended from the ceilings. In the one instance in which it could not be done, external construction to house the dehumidification equipment for the Coating Room was built.

Strong Cobb Arner Inc., on February 9, 1961, held an open house and began full scale production of its tablet manufacturing shortly thereafter. ▲▲

EQUIPMENT INSTALLED

Air handling units and fans	*Westinghouse Electric Corp., Sturtevant Div.*
Dust collectors and oil bath filter	*American Air Filter Co., Inc.*
Outside air filters	*Cambridge Filter Co.*
Refrigeration condensing units	*The Trane Co.*
Dehumidifier	*Bryant Mfg. Co.*
Cooling tower	*Marley Co.*
Air outlets	*Anemostat Corp. of America*
Controls	*Powers Regulator Company*
Humidity control equipment, Kathabar	*Surface Combustion Div., Midland-Ross Corp.*
Air recovery charcoal cells, Dorex	*Connor Engineering Corp.*
Cycoil units	*American Air Filter Co., Inc.*
Reheat coils	*Aerofin Corp.*
Reheat and preheat coils	*Westinghouse Electric Corp., Sturtevant Div.*
Cooling coils	*Aerofin Corp.*
Air dryers	*Pittsburgh Lectrodryer Div., McGraw Edison Co.*

"Hello, Acme Ventilating Co.? About this 'fresh as the North Woods' ventilating system. . . ."

Ventilating Transfer of Drummed and Bagged Solids

(Continued from page 29)

enclosure for the equipment into which the product is dumped and a portable slot hood to control the dust created in the drum during shovelling or scooping. A control velocity of 125 fpm will usually provide satisfactory control at the hood enclosure. The control volume required for the slot hood may be determined by multiplying the area to be controlled by 150.

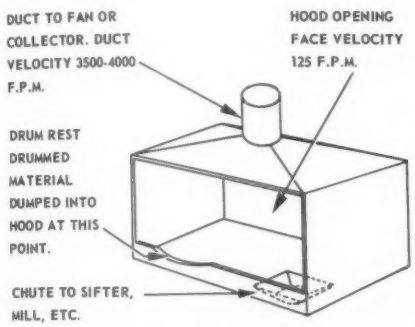

DUCT TO FAN OR COLLECTOR. DUCT VELOCITY 3500-4000 F.P.M.
HOOD OPENING FACE VELOCITY 125 F.P.M.
DRUM REST DRUMMED MATERIAL DUMPED INTO HOOD AT THIS POINT.
CHUTE TO SIFTER, MILL, ETC.

Fig. 3: Hood for control of dust liberated during manual feeding of material to sifter, mill, etc., on floor below.

This control may be also realized by a hood enclosure as shown in Fig. 3 and mechanical exhaust ventilation. The material is dumped onto the floor of the hood enclosure and is shovelled or scooped from there directly into the process equipment. The dust created during the shovelling or scooping is under ventilation control.

Hood Enclosure

The hood enclosure shown may be adapted to accommodate a drum in an inclined position so that shovelling or scooping may be made directly from the drum.

A control velocity of 125 fpm across the face of the hood will usually provide satisfactory control.

The transfer of solid material from bags to process equipment is usually accompanied by the evolution of dust. If the material is toxic or irritating, control of the dust may be required.

Dust control of the transfer operation may be realized utilizing a hood enclosure such as is shown in Fig. 4 in conjunction with mechanical exhaust ventilation. The hood may be equipped with a platform upon which the bag to be emptied may be placed for cutting or opening the bag before it is emptied. A control velocity of 125 fpm will usually provide satisfactory control.

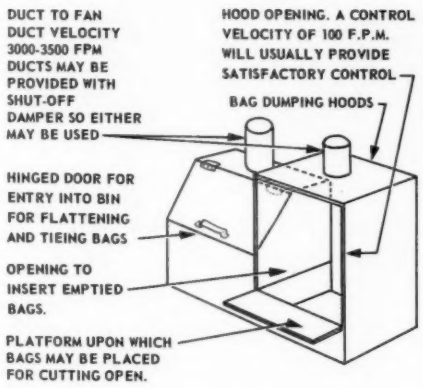

DUCT TO FAN DUCT VELOCITY 3000-3500 FPM DUCTS MAY BE PROVIDED WITH SHUT-OFF DAMPER SO EITHER MAY BE USED
HOOD OPENING. A CONTROL VELOCITY OF 100 F.P.M. WILL USUALLY PROVIDE SATISFACTORY CONTROL
BAG DUMPING HOODS
HINGED DOOR FOR ENTRY INTO BIN FOR FLATTENING AND TIEING BAGS
OPENING TO INSERT EMPTIED BAGS.
PLATFORM UPON WHICH BAGS MAY BE PLACED FOR CUTTING OPEN.

Fig. 4: Mechanically exhausted bin for controlling residual dust from emptied bags. Bags are inserted through opening into bin and flattened and tied with benefit of local exhaust ventilation.

Residual Dusts

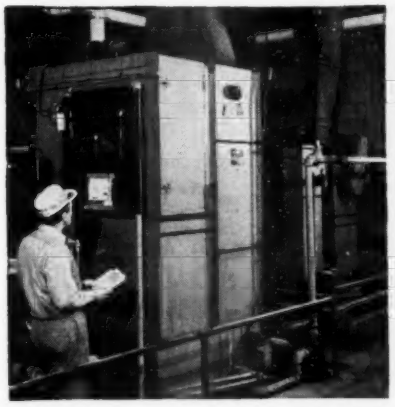
In some operations, residual dusts from the emptied bags may present an exposure problem. A hood enclosure in which the emptied bags may be stored and tied is also shown in Fig. 4. The same control air volume may be used for this enclosure by providing shutoff dampers for duct. ▲▲

Use the Communications Center, page 51, to receive more information about any product advertised, any new literature or new product described. Circle the number on the postage-free card that refers to the item of your interest, add your name and address and mail.

To comment or make suggestions about any article in this issue, use the Editorial comment card.

DRY and CLEAN AIR at the RIGHT TEMPERATURE

- to control your product quality
- to protect a critical operation
- to protect apparatus from moisture damage
- to DRY your material or product
- to control packing or storage conditions
- to assure precision in testing or research
- to increase air conditioning capacity



Air Condition by the NIAGARA Method Using HYGROL Liquid Absorbent

This compact method, giving high capacity in small space, removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the air.

Most effective because... it removes moisture as a separate function from cooling or heating and so gives a precise result, and always. Niagara machines using liquid contact means of drying air have given over 20 years of service. The apparatus is simple, parts are accessible, controls are trustworthy.

Most reliable because... the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions... no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

Most flexible because... you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Write for Bulletins 112 and 131 and complete information on your air conditioning problem.

NIAGARA BLOWER COMPANY

Dept. AIR-6, 405 Lexington Ave., New York 17, N.Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

[For more information circle #28 on page 51]

New PRODUCTS

To receive information on any of the New Products, circle the item reference number on the postage-free reply cards on page 51, Communications Center.

Ceiling Type Heavy Duty Air Conditioner

Purpose: Correct-Air Corporation has added a ceiling type air conditioner to its line of heavy duty air conditioners.

Features: The systems are used in high ambient temperatures up to 180° F., odiferous and gaseous atmospheres, and where dirt persists. The CE 23, like all other Correct-Air models, heats in winter, cools and dehumidifies, and removes dirt, odors and noxious fumes.

Circle #71 on page 51.

Spray-On Filter Coating

Purpose: New "Puracon Filter Coat," packaged in 16-oz. aerosol cans, "sprays on any clean filter in a normally effective forced-air heating or cooling system, transforming it into an air cleaner-deodorizer," according to Worth Chemical Products.

Features: Puracon has a glycol base that dissolves common organic gases and it contains quaternary ammonia.

Circle #72 on page 51.

Supply Or Exhaust Fan

Purpose: Manufactured by the Greenheck Fan and Ventilator Corp. fan may be used for either supply or exhaust.

Features: The sidewall axial belted fan called the "Sab-Line" may be used for supply or exhaust by simply reversing the blade. Sizes range from 24 in. to 48 in.

Circle #73 on page 51.

Side-Fired Boilers

Purpose: Compact unit reducing floor space 20 percent, according to Eclipse Boiler Division of Eclipse Fuel Engineering Co.

Features: Gas, oil, or combination gas/oil-fired models, rated at 6, 12, 15, 20, and 30 hp, operates from 201,000 to 1,005,000 Btu/hr output at 100 or 125-lb working pressure standard, pressures to 500 lb. w. p.

All tubes below water line to prevent corrosion from oxygen and carbon dioxide.

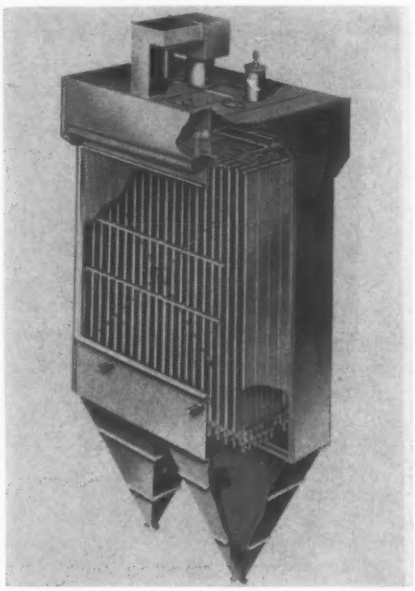
Boiler shell fully insulated with fiberglas, covered with steel jacket, welded, X-rayed, stress-relieved, and mounted on structural steel skids.

Circle #74 on page 51.

Electrostatic Precipitator With Flat Collector Plate

Purpose: Custom built to any dust collection problem by American-Standard Industrial Division.

Features: Flat plate collector design contains "pockets" to trap and hold the dust, reducing the chance of re-entrainment. Non-welded, roll-formed plate construction minimizes warping.



Silicon, selenium, high voltage vacuum tube (Kenotron), or mechanical high voltage rectifiers.

Choice of control: the saturable reactor which is a variable inductance DC control; monocyclic network consisting of a constant-voltage to constant-current transforming device; and the resistor type which is a variable resistance arrangement. All control options can be fully automated.

Circle #75 on page 51.

New Centrifugal Fans

Purpose: Small direct-connected, belted and portable models, as well as volume models, and pressure exhaust fans are available from General Blower Co.

Features: Type BG Util-A-Vent direct-drive models in five sizes and 14 capacities for low-pressure and small-volume. Type FC Belted Util-A-Vents in two models with adjustable V-belt drives where speed adjustments are required.

Type GP volume centrifugal fan in four sizes and nine capacities for small exhaust where resistance is caused by long run of duct.

Type GPE pressure exhaust fans in four direct-connected and three belted sizes.

Circle #76 on page 51.

Vapor Tension Equipment Thermometers

Purpose: Remote temperature indicators for air ducts and temperature operated valves. From U. S. Gauge Division of American Machine & Metals, Inc.

Features: Thermometers are available optionally with USG's front or rear-adjusted Zero Set. Dial sizes are 2, 2½, and 3½ in. Drawn metal cases house the back-connected internals. The bourdon-tube is non-ferrous metal.

Circle #77 on page 51.

Impingement-Plate-Type Scrubbers

Purpose: For wet cleaning, absorption, or cooling resulting from a wide range of industrial processes.

Features: Scrubbing is accomplished by turbulent interaction of gas and liquid, as effected by the stainless steel impingement baffle plate. Both single and multiple impingement plate units are available. The single-stage scrubber handles dust loadings at inlet of up to 100 grains per cubic foot. It can remove sub-micron fumes to larger micron dust particles with an efficiency in excess of 99 percent on many types of dust, according to the W. W. Sly Co.

Liquid consumption is only 1 to

3 gallons per 1000 cfm at 20-40 psig. A single-stage unit can have a pressure drop as low as 2½ in.

Circle #78 on page 51.

Air-Handling Troffer For Light, Heating, And Cooling

Purpose: The Triple-Shell Lumi-Flo by the Benjamin division of Thomas Industries, Inc. for any type drop ceiling.

Features: Air passageway is isolated from troffer housing by fiberglas insulation and insulating air gap to prevent temperature variations affecting light output. Air-handling capacity is 0 to 200 cfm from a 1 x 4 or 2 x 4 ft. unit.

Circle #79 on page 51.

"Inductaire" Filter Dust Collector

Purpose: The Dustex Corp., "Inductaire" filter dust collector provides air/cloth ratios from 5 to 10 cubic feet per sq. ft.

Features: After the usual reverse air cycle has begun, collapsing the bag, an air nozzle in the cap at the top of each bag releases short pulses of air which induce a current of air from the top on down pushing the dust into the hopper.

"Inductaire" may be used on high temperatures up to 550°F. Sizes and combinations of units are available to meet any capacity requirements.

Circle #80 on page 51.

Variable Volume Reheat Unit

Purpose: For heating, cooling, and ventilating perimeter areas of commercial and industrial buildings.

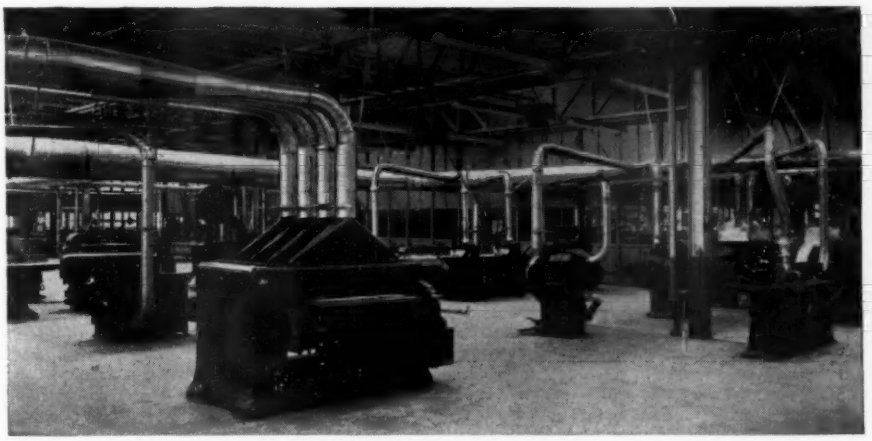
Features: According to Titus Corp. the Variable Volume Reheat Unit provides lower initial equipment costs, lower operating costs, and allows greater design freedom.

Fan capacity can be less when these units are designed into the variable volume reheat system. Due to solar orientation, all perimeter areas do not require maximum

(Please turn to following page)

For complete flexibility and expandability . . . exclusive K & B Plenum Main System.

No two dust control problems are alike!



Highly efficient, low cost Tapered Main System, for fixed machine location.

Since no two dust control problems are alike, a Kirk and Blum engineering survey determines the exact nature of *your* specific application. It's all part of K & B's *complete* service to assure you the best system for your particular need, all factors considered.

From survey time until the system is completed and in operation, Kirk & Blum handles the entire job with one undivided responsibility . . . a condition only possible when you have *one* source for all service, *one* guarantee for all components.

Write today for the new 52-page K & B Catalog or a no-obligation survey of your particular problem. The Kirk & Blum Mfg. Co., 3130 Forrer St., Cincinnati, 9, Ohio.

KIRK & BLUM *Complete Dust Control Systems*

[For more information circle #29 on page 51]

New PRODUCTS

(Continued from preceding page)

cooling or maximum flow at the same time. With variable volume it is then possible to design the fan capacity by the cooling air flow required at a specified time, rather than the total of the maximum flow required at each outlet in the perimeter area.

Can be installed under the floor or with outlets flush with floor or above floor at any height desired.

Circle #81 on page 51.

Oil Mist Precipitator

Purpose: May be used with all grinding operations.

Features: The unit is available in cfm capacities of 300, 600, and 1200. Self-contained, requiring only electrical connections and ductwork. Built by Trion, Inc., a circuit regulator provides built-in protection against overload of components and automatic compensation for 120 AC line voltage variations.

Circle #82 on page 51.

Air Cooled Condensers

Purpose: Heavy duty condenser with horizontal or vertical air flow for air conditioning and refrigeration, from McQuay, Inc.

Features: Available in 19 sizes from 7½ to 100 tons. Refrigerant condensing without water for all air conditioning and refrigeration applications for use with refrigerants 12, 22 or 500.

Circle #83 on page 51.

Protection Against Air Flow Failure

Purpose: A new Velocity Switch that is actuated by the air velocity in a duct and is not responsive to static pressure or suction has been introduced by Drying Systems Co.

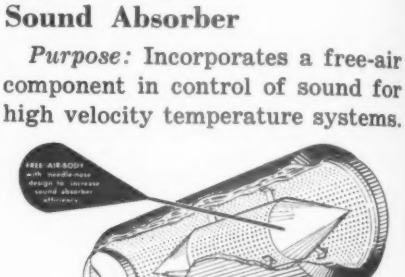
Features: The Velocity Switch can be mounted at any angle, and operates on either the inlet or discharge side of the fan.

Duct air is unable to pass through the Velocity Switch or external air to pass in the duct through the switch. Primary switch is magnetic, through a solid barrier. The switch responds to velocities as low as 1000 fpm.

Circle #84 on page 51.

High-Velocity Sound Absorber

Purpose: Incorporates a free-air component in control of sound for high velocity temperature systems.



Features: Constructed of heavy gauge galvanized sheet steel by the American Engineering Co., the Tubular is cylindrical and utilizes an absorber-within-an-absorber design. A 360° distribution of air entering the absorber creates minimum resistance to air flow.

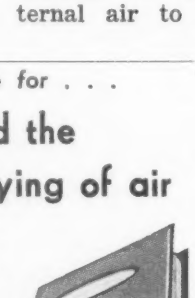
Circle #85 on page 51.

Outlining modern theory and practice for . . .

Efficient refrigeration and the cooling and dehumidifying of air

This book brings to readers a convenient reference on the basic theory and practices for the design and application of modern refrigeration and air conditioning equipment. The author puts special emphasis on the commercially-important vapor-compression cycle; however, more specialized types of refrigeration systems are also surveyed.

Principles of heat transfer are incorporated in the book to help in the analysis of the performance of actual refrigeration and air conditioning equipment. In addition, a unified treatment of heat- and mass-transfer explains the characteristics of heat-transfer devices for air conditioning.



Partial Contents

- Applications of Refrigeration and Air Conditioning
- Methods of Refrigeration
- The Vapor-compression Cycle
- Multipressure Systems
- Compressors
- Water-cooled and Air-cooled Condensers
- Expansion Devices
- Evaporators
- Refrigerants
- The Complete Vapor-compression System
- Absorption Refrigeration
- Air-cycle Refrigeration
- Steam-jet Refrigeration
- Low-temperature Refrigeration
- Heat Pumps
- Psychrometry
- Enthalpy Potential
- Cooling Towers and Evaporative Condensers

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By W. F. STOECKER

Assistant Professor of Mechanical Engineering, University of Illinois

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Butterfly Valves For Oval Ducts

Purpose: For rectangular and oval ducts. From the W. S. Rockwell Co.

Features: One-piece aluminum alloy body. The body has a "Keelok" replaceable rubber or synthetic resilient elastomer liner, against which the oval aluminum disc seats for tight closure.

Throttling and shutoff can be controlled by a lever, hand wheel or automatically by a pneumatic cylinder, diaphragm operator or electric motor. A dial indicates position of the disc. For automatic control, a valve positioner may be included.

The valves come in 14 sizes from 3 in. x 7 in. to 20 in. x 30 in.

Circle #86 on page 51.

New Line Of Air Handling Units

Purpose: Chrysler Airtemp Division has announced the addition of seven basic models of air handling units.

Features: The units are built in two sections for more flexible installation and have capacities ranging from 2,000 through 15,000 cfm.

Circle #87 on page 51.

Soft Cuff For Easy Flex Duct Disconnect

Purpose: Stretchable soft cuff for snug fit on nominal sized fittings and oversized end fittings.

Features: Produced by The Wiremold Company of two-ply, neoprene coated cotton net, resists abrasion, gas, and oil.

Circle #88 on page 51.

New Line Of Forward Curved Industrial Fans

Purpose: For heavy-duty industrial service.

Features: "FF" Industrial Fans for handling hot air or gases to 2000°F; and "FF" Thermal-Aire Plug Units for direct installation in furnaces, ovens, kilns, and dryers without external ductwork.

Heavy-gauge welded construction Garden City Fan & Blower

(Please turn to page 47)

PHOTOGRAPH COURTESY OF WESTERN ELECTRIC COMPANY

Angelica Uniforms and Victor Gloves Help Prevent Clean-Room Contamination

Victor Monofilament Nylon Gloves

Angelica has been appointed the only distributor of Victor Gloves, the finest protective gloves made. Victor's non-contaminating gloves of monofilament nylon with plastic coated palms, have maximum touch sensitivity for precision operations. Victor Gloves Inc. collaborated with Bell Laboratories, Inc., in developing these gloves and Bell is currently using them in the assembly of select devices sensitive to physical and chemical contamination.

Other models include ambidextrous gloves and gloves for LOX parts.

Static-Free Dacura* Uniforms

Angelica's coveralls and frocks, of comfortable moisture absorbent Dacura (Dacron** polyester and rayon), are non-linting, acid resistant and static-free. The tight weave of continuous filament yarns resists passage of contamination from the skin or undergarments.

There is a complete "engineer designed" line of Dacura, Dacron, or nylon uniforms and accessories by Angelica and Victor Gloves Inc.

Mail this coupon to the nearest Angelica office below.

*Reg. T.M. H. P. Ogden Co.
**Reg. T.M. of Dupont

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Send literature on White Room Uniforms and Gloves.

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[For more information circle #30 on page 51]

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New PRODUCTS

(Continued from page 45)

Co. "FF" fans are available from 7½ in. to 73 in. in wheel diameter with all standard arrangements for belt drive or direction connection. Gas-tight, corrosion-resistant or spark-resistant models are available. Accessories include discharge dampers, outlet and inlet flanges, access doors, drain connections, etc.

Circle #89 on page 51.

High Volume Discharge Blower

Purpose: Centrifugal, squirrel cage blowers for quiet operating free air discharge in exhaust and ventilation applications.

Features: Cast aluminum housings, steel impellers, non-overloading design, pedestal or direct mounting, and permanently lubricated ball bearing motors. The Cincinnati Fan & Ventilator Co. "LM" Volume Blowers are available in two sizes with motors from ⅛ to 1 hp, delivering 360 to 1400 cfm of free air. All models have 3-position mounting and are available with belt drive.

Circle #90 on page 51.

"V-Con" Condenser

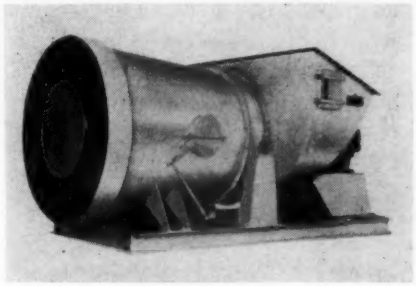
Purpose: The "V-Con" has recently been introduced by the Halstead & Mitchell Co. The unit is a remote air-cooled condenser with coils arranged in a V-shape so air is drawn through and discharged vertically upwards by the propeller fans.

Features: The "V-Con" is offered in capacities of three to 10 tons, with direct drive fans, totally enclosed motors, and lightweight corrosion resistant aluminum cabinets.

Circle #91 on page 51.

Axial Flow Fan With Adjustable Blades

Purpose: The American SF Products, Inc., SF Axial Flow Fan impeller blades allow the air flow to be regulated while the fan is in operation.



Features: Eliminates gearing. Fans may be used for motor speeds of 725, 980, or 1450 rpm. Forty-eight standard sizes available, flows from 30,000 to 600,000 cfm and a range up to 24 in. w. g.

Circle #92 on page 51.

Three-Pass Packaged Boilers

Purpose: Available for low or high pressure steam or hot water and designed for burning gas, oil, or combination fuels.

(Please turn to following page)

How to . . .

Solve automatic control problems faster . . . more efficiently

Here is a book that shows you how automatic control works in a heating or air conditioning situation . . . gives you information that you can apply in designing, installing, or servicing heating or cooling equipment. Avoiding analysis by mathematical formulas, this book shows you the **basic** problems likely to arise in various heating and air conditioning systems, and then gives you the **basic** principles for solving them. This is a practical book that takes you logically from means of measurement and means of actuation . . . through construction and characteristics of control devices . . . to the combination of individual devices into control systems.

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- Pneumatic-control Units
- Control of Domestic Heating
- Zone Control—Commercial Heating
- Control of Commercial Central-fan Cooling Systems
- Control of Commercial Refrigeration

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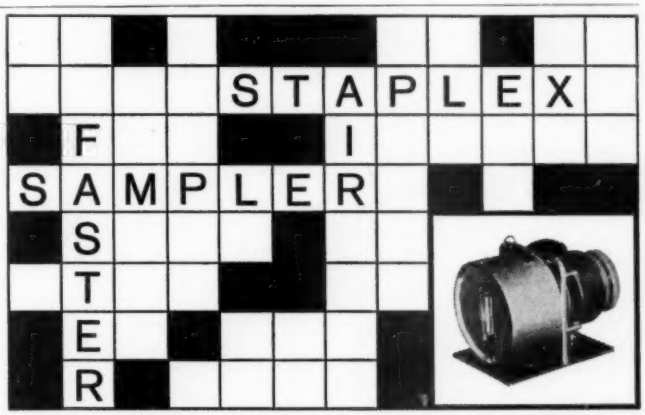

1. missile development
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4. mine inspection
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[Circle #31 on page 51]

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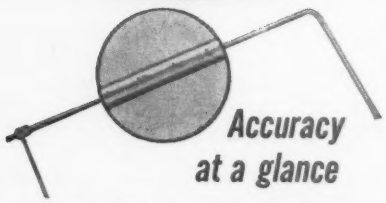
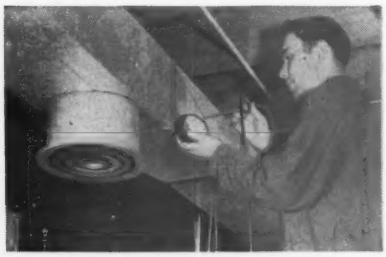


STAINLESS STEEL PITOT TUBES

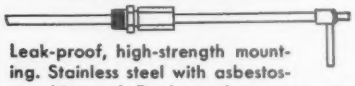
INCH-SCALED TO SHOW DEPTH OF INSERTION



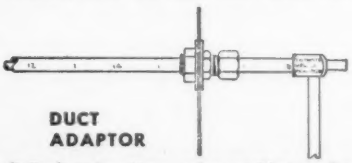
Dwyer No. 160 Pitot Tube being used to check air velocity with a No. 1010-1 Magnehelic Gage.

With inch graduation inscribed on *both* sides of the Dwyer Pitot Tube, you find the exact center of any duct immediately and make an accurate traverse. These Dwyer units feature lifetime stainless steel construction, accurate burr-free static holes and test-confirmed unity coefficients. They're available in a complete range of sizes from 12" to 60". With the mounting accessories shown below, they can be used for checking air velocities and static pressures in any kind of service. Dwyer Pocket-Size Air Velocity Calculator supplied with each Pitot Tube.

PACKING GLAND MOUNT



Leak-proof, high-strength mounting. Stainless steel with asbestos-graphite seal. For hazardous gases, etc.



DUCT ADAPTOR

Split ferrule allows tube position to be changed without disconnecting. Solid brass construction.

SPLIT FLANGE MOUNT

Split halves, neoprene gasket and hardware supplied for attaching to any duct. Fits all standard pitot tubes.

F.W. DWYER MFG. CO.

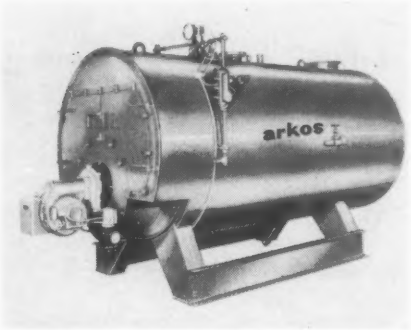
P.O. Box 373-A Michigan City, Ind.

[Circle #32 on page 51]

New PRODUCTS

(Continued from preceding page)

Features: The Arkos Manufacturing Co. boilers have forced draft design ranging from 15 h.p.



to 500 h.p.; front-end cleaning; rear door for inspection; elimination of horizontal refractory baffles; large furnace volume; and 5 sq. ft. of heating surface per boiler horsepower.

Circle #93 on page 51.

Polypropylene Multifilament-Spun Staple Filter Fabrics

Purpose: Hot, corrosive applications involving the separation of gelatinous precipitates and fine or abrasive dusts, according to Technical Fabricators, Inc.

Features: Woven from filament warps and staple fillings. Plain and twill weave variations to combine cake release characteristics of filament constructions plus abrasion resistance and resilience of staple fabrics. Available as fabricated elements or yard goods.

Circle #94 on page 51.

Heat Exchanger With Removable Bundles And Full-Floating Heads

Purpose: Where frequent cleaning of tubes is necessary and/or thermal differential expansion between the shell and tubes becomes a problem. Will handle any combination of liquids and gases, including toxic, volatile, or flammable.

Exchangers may be used as heaters, coolers, condensers, or vaporizers.

Features: American - Standard Industrial Division series C-500 heat exchangers with floating head clamp-ring design are built from standard, pre-engineered components assembled into custom units.

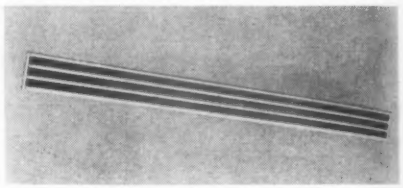
Available in 19 shell sizes from 6 through 42 in. and with any practical tube length in two, four, or six tube pass arrangements. Shell-side and tubeside design pressures range from 75 to 300 psi. Design temperatures up to 650°F on shell and tubeside are permissible with carbon steel construction, depending on operating conditions.

Exchangers can be mounted horizontally or vertically. Cradles or mounting brackets can be furnished loose or welded in place.

Circle #95 on page 51.

Straight Line Diffusers

Purpose: To permit the use of high cooling temperature differentials.



Features: The new Anemostat ASL Architectural Straight Line Air Diffuser is economical, attractive, and easy to install.

Circle #96 on page 51.

Fume Head Monitor

Purpose: Warning alert should air flow be reduced below pre-set safe, adjustable limits in a fume hood. From Waber Electronics, Inc.

Features: Combination buzzer sound and red warning light. Time delay in the basic circuitry to prevent nuisance alarms.

Circle #97 on page 51.

Heating And Cooling Roof-Top Unit

Purpose: For commercial and industrial applications from the air conditioning division of Westinghouse Electric Corp.

Features: To facilitate handling, shipping, and adaptability, the unit is divided into two separate com-

ponents, one for cooling and one for heating.

Total cooling capacity is 75,900 Btu and total output of the gas furnace portion is 160,000 Btu.

Cooling portion consists of an air-cooled condensing unit, evaporator coil, and control box. Heating portion has two furnaces, filters, and two fans driven by a one-horsepower motor.

Circle #98 on page 51.

Air Velocity Transducer

Purpose: Measurement of low velocity air flow, designed by Alnor Instrument Co.

Features: Air flow sensing element with a read-out system retaining sensing element accuracy. The sensing element, or transducer, is available in models for deflection-type indicator read-outs or potentiometric read-outs. May be used in air temperatures from 20 to 250°F.

Read-out options include, indicators, records, signal alarms, and controllers.

Circle #99 on page 51.

Automated Proportional Air Pressure Controller

Purpose: Air-actuator systems, flow control, mixing and blending, automatic air-conditioning control. From Automation Development Corp.

Features: Regulated air pressure output, externally programmable to operate proportionally controlled air actuator directly or proportionally controlled pilot for water, hydraulic, or air systems.

Performance characteristics: input air pressure of 30 psi (maximum); output air pressure is externally programmable from 0 to 30 psi in ½ (nominal) psi increments; regulation is 1 percent over output range; response time to 50 increments (½ psi) per second (depends on code signal); external program input is specified audio tones of 10 cycles minimum duration and 15 volts rms minimum amplitude from magnetic tape. (Input impedance 5K minimum); power required is 115 volts AC, 60 cps, single phase, 100 watts.

Circle #100 on page 51.

Adjustable Suction Tube For Unit-Type Dust Collectors

Purpose: Eliminates need for permanent ductwork and increases efficient use of cabinet cloth filter collectors, according to Torit Manufacturing Co.

Features: Flexible, fabric hose supported by sturdy, lightweight arms which pivot to allow movement. Highly efficient dust nozzle.

Available in 3 and 4 in. hose diameters. Tube assembly rotates through a full 360 degrees and has up-and-down travel of nearly 8 ft.

Circle #101 on page 51.

Multizone Heating, Ventilating Units

Purpose: For schools, institutions, industrial and commercial buildings, and similar applications. Manufactured by Recold Corp.

Features: Ten sizes from 1,000 to 35,000 cfm, with optional filter boxes, mixing boxes, and preheat coils are available on the WMH (horizontal) and WMV (vertical) units.

Circle #102 on page 51.

IS DUST YOUR PROBLEM?
Then MIRACLE MAT is your answer . . . because MIRACLE MAT stands guard against walk-in dirt and dust . . . and is completely automatic!
Time-tested MIRACLE MAT meets rugged specifications of clean rooms across the nation.
"the miracle mat"
U. S. PATENT
Write to
PROGRESSIVE ENGINEERING CO.
HOLLAND, MICHIGAN

[Circle #33 for more information]

SPECIAL CHAIRS FOR WHITE ROOMS AND DUST FREE AREAS
• All Enclosed Mechanism
• No Oil or Grease
• All Chrome Plate Finish
• Easily Cleaned
• 12 Ga. All-Steel Seat; 14" x 15¾"— Waterfall Form. Sand Blast Surface. Adjusts 18" to 26".
• 12 Ga. Steel Backrest; 6" x 13¾"—with tempered steel backrest support. 6 inch horizontal adjustment. Backrest folds down to make easy cleaning.
• Cast Iron Base; 20-inch spread. 1¼" steel glides.
Other White Room chairs with lacquered plywood seat and backrest.
FREE TRIAL Use an AJUSTRITE chair for 30 days without obligation. Prove to yourself the many advantages AJUSTRITE offers in comfort, utility and economy. Write today—we'll do the rest.
10 YEAR GUARANTEE
Model CSSC-1826-CP
JUST LIFT SEAT TO DESIRED HEIGHT
32 Models for Factories • Schools • Laboratories • Hospitals • Offices
AJUSTRITE CHAIRS AND STOOLS
AJUSTO EQUIPMENT CO.
Bowling Green, Ohio

[Circle #34 for more information]

New Literature

To receive information on any of the New Literature listed on the following pages, circle the item reference number on the postage-free reply cards on page 51, Communications Center.

New Non-Woven Filter Material

Literature on a new low density non-woven 99.+% efficiency filter material, trademarked Hovolite® and developed by the Hollingsworth & Vose Co.

Circle #132 on page 51.

1961 Incinerator "Blue Book"

Specifications and suggestions for selection and layouts of typical incinerator installations released by Joseph Goder Incinerators.

Circle #133 on page 51.

Cooling Tower Brochure

Description of Drayer-Hanson's 13-model (5 thru 80 nominal ton) line of cooling towers including: entering and leaving tower water temperature, water flow gpm, and nominal capacity tons refrigeration.

Circle #134 on page 51.

"The Electronic Handbook"

Barber-Colman Company covers the application of electric and electronic controls in commercial and industrial air conditioning installations.

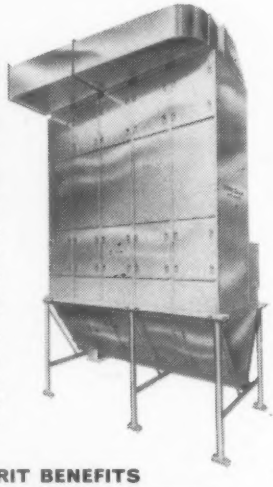
Circle #135 on page 51.

Relative Humidity Control

A 67-page booklet explaining the precision measurement and relative humidity control products of Hygrodynamics, Inc.

Circle #136 on page 51.

NEW TORIT DUST COLLECTOR IS AUTOMATIC!



Save real dollars with the benefits from this automatic dust collector. No more interruptions on production lines! Maintenance problems are practically eliminated. This all new continuously cycling TORIT dust collector automatically cleans your air and automatically shakes its own filters and blows them clean with reverse air flow. Collected material is emptied automatically.

OTHER EXCLUSIVE TORIT BENEFITS

- automatic filter-shaker mechanism is simple, maintenance-free
- different dusts may be collected separately
- highest air-to-cloth ratios (from 5 to 25:1) and longer filter life
- only ¾ H.P. required for fully automatic operation
- polished ¾" aluminum construction for minimum floor loading
- modular design—5' wide x 4'-8" long (for two sections) x 15'-6" high—saves space, lends ease and versatility to installation. Use up to 12 modular sections for each application! No limit to CFM capacity!

Write today for literature.

TORIT MANUFACTURING COMPANY
Automatic Collector Division
1133 Rankin Street, St. Paul 16, Minnesota, Dept. 1935

[For more information circle #35 on page 51]

Sticky Mats For White Room

A brochure by the Clean Tread Division of the Merit Paper & Chemical Co. explaining what a sticky-mat is, what it will do, where to install, and how to use it.

Circle #137 on page 51.

"Properties And Selection Of Metals"

The American Society For Metals announces publication of a new 1300-page ASM Metals Handbook, "Properties And Selection Of Metals."

Circle #138 on page 51.

Air Flow Calculator Slide Rule

A rule to determine outlet and size and air flow, released by the Titus Manufacturing Corp.

One side of the rule is air flow calculator, other side is an outlet selector.

Circle #139 on page 51.

Roof Exhaust Fans Brochure

Brochure describing low-velocity, high capacity Davidson Fan Co. roof exhaust fans. Contains dimension table and diagram, capacity table, and typical specifications.

Circle #140 on page 51.

Chemical Method For Air Pollution Control

A method of chemically eliminating odors resulting from industrial processing and municipal sewage operation has been published by Rhodia Inc.

Circle #141 on page 51.

New Edition Of ARI Certified Unitary Directory

Carries certified ratings on more than 2,700 units of 53 manufacturers participating in the Unitary Air-Conditioner Certification Program sponsored by the Unitary Air-Conditioner Section of ARI.

Circle #142 on page 51.

(Please turn to page 52)

Infrared Comfort Heating

Typical applications, advantages, equipment and service, dimensions, and engineering information is detailed in a new booklet published by the Fostoria Corp.

Circle #151 on page 51.

Brochure On Duct Silencers

Detailed information on Silence, Inc., complete line of standard prefabricated circular duct silencers for ventilating and air conditioning systems.

Circle #152 on page 51.

Air Pollution Conference Report

A report on the Third Air Pollution Research Seminar held in New Orleans, March, 1960 has been issued by the U. S. Department of Health, Education, and Welfare.

Circle #153 on page 51.

Reprint On Separating Fine Dust From Crushed Material

Buell Engineering Co., Inc. offers reprints of an article describing the first U. S. application of their new high-efficiency inertial classifier.

Circle #154 on page 51.

Humidity Measuring Instruments

Released through the University of Florida Engineering and Industrial Experiment Station, a "Comparison of the Accuracy of . . . Humidity Measuring Instruments," by F. M. Flanigan.

Circle #155 on page 51.

Dust Control Through Preventative Methods

An 11-page booklet from J hnson-March Corp., on methods of dust control rather than collection.

Circle #156 on page 51.

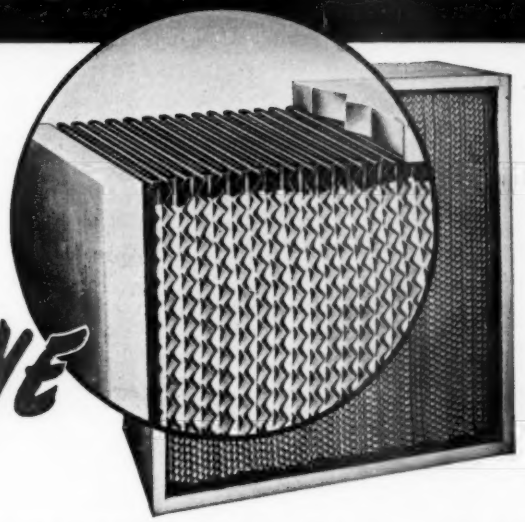
New Fan Bulletin

Condensed 8-page centrifugal fan bulletin is now available from Ilg Electric Ventilating Co.

Circle #157 on page 51.

(Please turn to following page)

Prevent Air and Product Contamination with Cambridge ABSOLUTE® Filters

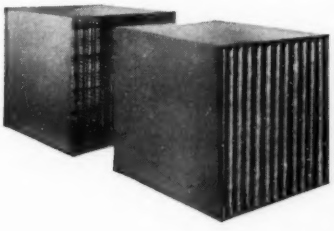


The *POSITIVE* Filter

Guaranteed 99.97% Efficient on 0.3 Micron Particles

The Cambridge ABSOLUTE filter has long been the standard of quality for the removal of radioactive particles from air. It is available in a wide range of models which are resistant, as required, to temperature, humidity, fire and corrosion. All filters are individually tested and the penetration of 0.3 micron D.O.P. aerosols is guaranteed not to exceed 0.03%.

Write for Bulletin 106C



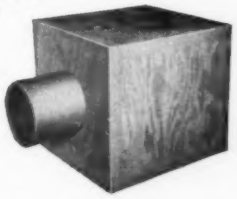
Cambridge AEROSOLVE® Filters

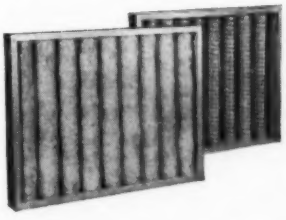
35% to 95% Efficient on Atmospheric Dust

Available in three efficiencies – 35%, 85% and 95%, NBS test method with atmospheric dust – and for face velocities of 450 f.p.m. and 250 f.p.m. Permanent cadmium-plated frames with easily installed, interchangeable cartridges. Write for Bulletin 132. *Frame to hold combination AEROSOLVE-ABSOLUTE filter described in Product Data Sheet 136.*

Self-Contained ABSOLUTE Filters

Easily installed in exhaust systems, they eliminate filter-sealing problems and prevent loss of accumulated material during filter change. Available for wide range of operating conditions. Write for Product Data Sheet 108.



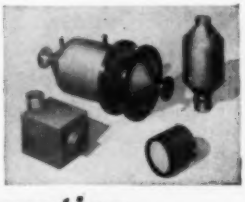


Radioactive Hood Prefilters

Cambridge Hood Prefilters capture the major portion of any gross contamination – extend the life of the ABSOLUTE filters in the exhaust system – make clean-up easier and less costly. Product Data Sheet 160. *Special Perchloric Acid Hood Prefilters described in Product Data Sheet 165.*

Pressure-Vessel and Pipe-Line Filters

Cambridge ABSOLUTE Filters can be made in a wide range of special sizes and shapes. Write for information regarding your specific needs.



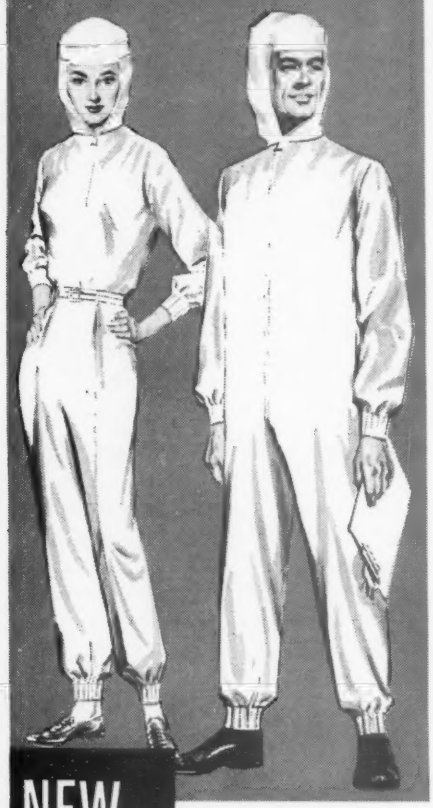
Cambridge® Filter Corporation

744 East Erie Boulevard, Syracuse 1, N.Y.

[For more information circle #36 on page 51]

LINT-FREE

INDUSTRIAL APPAREL for CLEAN ROOMS



NEW... shirts . . . trousers . . . coveralls . . . lab coats...ladies slack sets...dresses . . . caps . . . shoe covers . . . gloves . . . designed by

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company.....
address.....
city.....zone.....state.....

[Circle #37 on page 51]

New Literature

(Continued from preceding page)

White Room Enclosures

A 31-page book from Kewaunee Scientific Equipment detailing their complete line of white room safety enclosures including: controlled atmosphere systems; CBR system; vacuum boxes; dust free enclosures; and other special enclosures.

Circle #158 on page 51.

Gas Detector Booklet

Operation and make-up of Brothers Chemical Model 60 Gas Detector.

Circle #159 on page 51.

New Brochure On Cyclone Collectors

John Wood Company describes their improved design cyclone collector with emphasis on tube and vane design. Dimensional data, efficiency curves and volume-draft loss nomographs are included.

Circle #160 on page 51.

Infrared Radiation

Book by Henry L. Hackforth, Nortronics, Div. of Northrop Corp., explains what infrared radiation is, what it does, and how it is used.

Containing 288 pages it is priced at $10.

Circle #161 on page 51.

Industrial Gas Equipment For Heat Process Engineering

Application of commercial gases to industrial processes is described and illustrated in this 16-page brochure from Gas Appliance Service, Inc.

Circle #162 on page 51.

Dust Handling Equipment

Buell Engineering Co., Inc., describes its complete line of Buell-Norblo dust collecting, recovery, and classifying equipment.

Circle #163 on page 51.

"Dust Spot Test— What Is It?"

Westinghouse Electric Corp. explains why the soiling effect of air is a useful index to its dust content and how this index is used to determine the efficiency of air cleaners in the U. S. Bureau of Standards Dust Spot Test.

Circle #164 on page 51.

Airtemp Catalog

Chrysler Airtemp folder lists complete 1961 line of centrifugal water chillers, air handling equipment, central station air conditioning units, packaged liquid chillers, radial compressors, condensing units, cooling and heating units and fan coil equipment.

Circle #165 on page 51.

AMCA Official Directory

Directory of Products licensed to carry the AMCA Certified Performance Rating Seal has been issued by the Air Moving & Conditioning Association, Inc.

Circle #166 on page 51.

Portable Filter Vacuum Cleaner

A 4-page illustrated bulletin from Cambridge Filter Corp. describes portable vacuum cleaner designed to handle radioactive and toxic dusts.

Circle #167 on page 51.

Federal Control Of Air Pollution?

John Wood Co. opposes this trend as being unrealistic, suggests solutions for national problem, makes a sound case for maintaining control at the local level.

Stresses a workable partnership between government and industry is feasible and desirable, and would support local control.

Circle #168 on page 51.

Reprints

Directory Of Supplies And Equipment For White Rooms

Listings of products designed for White Rooms, other than conventional air conditioning, fans, blowers, air outlets, etc.

Circle #171 on page 51.

Economics Of Factory Air Conditioning

New accounting methods to prove before buying and installing air conditioning, that the investment will pay off as well or better than any other piece of capital equipment. Price .75¢

Circle #172 on page 51.

Primer On Factory Ventilation

Data on use of three basic make-up air systems, factors influencing sizing, types of equipment, temperature controls, filtering, air distribution, system numbering, and cost factors involved. Price .75¢

Circle #173 on page 51.

The Meaning Of Clean Air

By Robert H. Avery, Director, Application Engineering, Cambridge Filter Corp., Syracuse, New York.

Authoritative data on design and construction of dust-free "white rooms." Price .75¢

Circle #175 on page 51.

Special Report On White Rooms

Discusses White Rooms as a market, equipment and supplies used in White Rooms, and White Room marketing channels.

Circle #176 on page 51.

Balancing Big Building Air Conditioning

By S. A. Littmann, Giffels & Rossetti, Inc., Detroit.

Tells who should be responsible for system balancing and outlines various methods and techniques of balancing. Price .75¢

Circle #177 on page 51.

White Room Symposium Papers

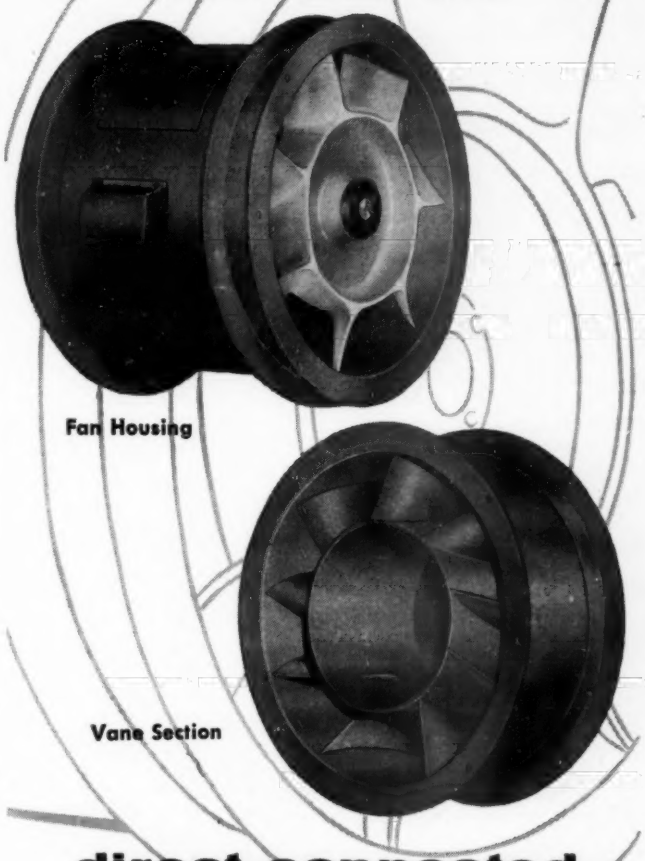
Presented at American Institute of Plant Engineering Symposium on Dust Control, Tempe, Ariz., Nov., 1960. Price $5.00 (used for start of new American Assoc. For Contamination Control, see editorial).

Papers include: Determination And Detection Of Air Contaminants; Environmental Control; White Room—Ultra Precision Instruments; Dust Control And White Rooms; White Room—Electronic Tube Industry; Dust Monitoring In The Super-Clean Room By The Dry Slide Settling Technique; Philosophy Of Dust Control At Autonetics.

Circle #178 on page 51.

another outstanding design development from

Aerovent



direct-connected
vaneaxial
fans
with removable vane sections

Engineered for high-pressure, high-velocity air distribution systems, these units feature a unique removable vane section which simplifies installation and permits easy access for routine cleaning and maintenance.

Available in 30 models in sizes 18" to 48" for capacities from 3230 to 67,300 cfm with special design features for all application requirements.

Write for Bulletin 475

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

CERTIFIED PERFORMANCE

Aerovent

Aerovent
FAN COMPANY, INC.
ASH AND BRIAN STREETS PIQUA, OHIO
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POSITIONS WANTED

DUST COLLECTING Engineer—Manufacturers' representative seeking additional or new allied lines. Fifteen years' experience in all phases—systems, cyclones, bag collectors, washers and pneumatic conveying. Now serving territory 150-mile radius of Chicago. BOX AE-6611, Air Engineering.

POSITIONS AVAILABLE

METEOROLOGIST: Under general direction to plan and coordinate meteorological studies in relation to air pollution and its control. Salary: $7,000-$8,480. Qualifications: Bachelor's degree including or supplemented by 20 semester credit hours in meteorology and 3 years of professional meteorological experience. Graduate study in meteorology may be substituted for experience on a year for year basis. Write to R. H. Mattox, Personnel Director, NEW YORK STATE DEPARTMENT OF HEALTH, 84 Holland Avenue, Albany, New York.

DUST COLLECTING ENGINEER

AAAA Ohio manufacturer is seeking an engineer with a minimum of five years' experience in the application and sales of industrial dust collecting equipment. This is an unusual opportunity in a newly created product line. Give full background in letter directed to

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